# Middle Santa Ana River Watershed Bacterial Indicator TMDL: Triennial Report

February 15, 2010

CDM

ON BEHALF OF

Santa Ana Watershed Project Authority

San Bernardino County Stormwater Program

County of Riverside

Cities of Chino Hills, Upland, Montclair, Ontario, Rancho Cucamonga, Rialto, Chino, Fontana, Norco, Corona, Riverside, Pomona, and Claremont

Agricultural Operators

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# Section 1
# Introduction

## 1.1 Background

Various waterbodies in the Middle Santa Ana River (MSAR) watershed are listed on the state 303(d) list of impaired waters due to high levels of fecal indicator bacteria (FIB). The MSAR Bacterial Indicator TMDL ("MSAR Bacteria TMDL") was adopted by the Santa Ana Regional Water Quality Control Board (RWQCB) and approved by the State Water Resources Control Board to address these impairments (RWQCB 2005). EPA Region 9 approved the MSAR Bacteria TMDL on May 16, 2007 making the TMDL effective.

The MSAR Bacteria TMDL requires implementation of a watershed-wide compliance monitoring program for bacterial indicators. This program was initiated in July 2007. The TMDL requires that periodic monitoring reports be submitted to the RWQCB. The first report covered both the dry and wet seasons of 2007-2008. Subsequently, biannual (December – dry season report; May – wet season report) have been submitted to the RWQCB (December 2008, May 2009, and December 2009). Biannual reports will continue to be submitted in the future.

In addition to these regular reporting requirements, the TMDL requires preparation of a water quality assessment every three years that summarizes the data collected for the preceding three year period and evaluates progress towards achieving the wasteload and load allocations. This requirement is also included in the San Bernardino County and Riverside County Municipal Separate Storm Sewer System (MS4) permits (Section V.D.1.iii and Section VI.D.1.a.iii, respectively, permit adopted by RWQCB on January 29, 2010).

This document provides the first three year water quality assessment for the MSAR Bacteria TMDL – fulfilling both TMDL and MS4 permit reporting requirements. It summarizes the results of watershed-wide compliance sampling conducted from 2007 to 2009. This assessment also summarizes wet weather FIB concentrations observed at monitoring locations established by agricultural dischargers.

## 1.2 TMDL Requirements

In 1994 and 1998, because of exceedances of the fecal coliform objective established to protect the REC-1 use, the RWQCB added the following waterbodies in the MSAR watershed to the state 303(d) list of impaired waters:

- Santa Ana River, Reach 3 – Prado Dam to Mission Boulevard
- Chino Creek, Reach 1 – Santa Ana River confluence to beginning of hard lined channel south of Los Serranos Road

- Chino Creek, Reach 2 – Beginning of hard lined channel south of Los Serranos Road to confluence with San Antonio Creek
- Mill Creek (Prado Area) – Natural stream from Cucamonga Creek Reach 1 to Prado Basin
- Cucamonga Creek, Reach 1 – Confluence with Mill Creek to 23rd Street in City of Upland
- Prado Park Lake

The 2005 RWQCB-adopted TMDL for these waters established compliance targets or wasteload allocations (WLA) and load allocations (LA) for both fecal coliform and *E. coli*. The WLAs apply to urban runoff including stormwater runoff and dischargers from Concentrated Animal Feeding Operations (CAFOs); the LAs apply to agricultural runoff discharges and natural sources. Regardless of the allocation (WLA or LA), the FIB numeric targets are the same:

- Fecal coliform: 5-sample/30-day logarithmic mean less than 180 organisms/ 100 mL and not more than 10% of the samples exceed 360 organisms/100 mL for any 30-day period.
- *E. coli*: 5-sample/30-day logarithmic mean less than 113 organisms/100 mL and not more than 10% of the samples exceed 212 organisms/100 mL for any 30-day period.

# Section 2
# Watershed-Wide Compliance Monitoring Program

The MSAR Bacterial Indicator TMDL requires urban and agricultural dischargers to implement a watershed-wide bacterial indicator monitoring program by November 2007 (RWQCB 2005). The dischargers worked collaboratively through the MSAR Watershed TMDL Task Force[1] ("Task Force") to develop this program and prepare a Monitoring Plan (SAWPA 2008a) and Quality Assurance Project Plan (QAPP) (SAWPA 2008b)[2]. The TMDL Task Force implemented the monitoring program in July 2007 following RWQCB approval of program documents.

SAWPA (2009a) summarizes the findings from the 2007 dry season and 2007-08 wet season monitoring. SAWPA (2009b) and SAWPA (2009c) summarize the findings from the 2008 dry and 2008-2009 wet seasons, respectively. SAWPA (2009d) summarizes the results from the 2009 dry season.

## 2.1 Watershed-Wide Compliance Monitoring Sites

The TMDL Task Force established five watershed-wide compliance monitoring sites in the MSAR watershed. Table 2-1 and Figure 2-1 identify the locations sampled from 2007 to 2009 [3]. Attachment A of the Monitoring Plan (see footnote 2) provides additional information about each sample location.

**Table 2-1. Watershed-wide compliance monitoring program sample locations**

| Waterbody | Sample Location | Site Code |
|---|---|---|
| Icehouse Canyon | Near Icehouse Canyon Trailhead Parking Lot | WW-C1 |
| Prado Lake | Prado Lake Outlet | WW-C3 |
| Chino Creek | Central Avenue | WW-C7 |
| Mill-Cucamonga Creek | Chino-Corona Road | WW-M5 |
| Santa Ana River | MWD Crossing | WW-S1 |
| Santa Ana River | Pedley Avenue | WW-S4 |

[1] This Task Force includes representation by key watershed stakeholders, including stormwater programs for Riverside and San Bernardino Counties, agricultural operators, RWQCB, and SAWPA.
[2] The Middle Santa Ana River Monitoring Plan and Quality Assurance Project Plan are available at http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/msar_tmdl.shtml
[3] Prior to the 2009 dry season, Icehouse Canyon was included as watershed-wide compliance monitoring site. However, with RWQCB approval the Task Force removed this site from the sampling program prior to the start of the 2009 dry season monitoring program.

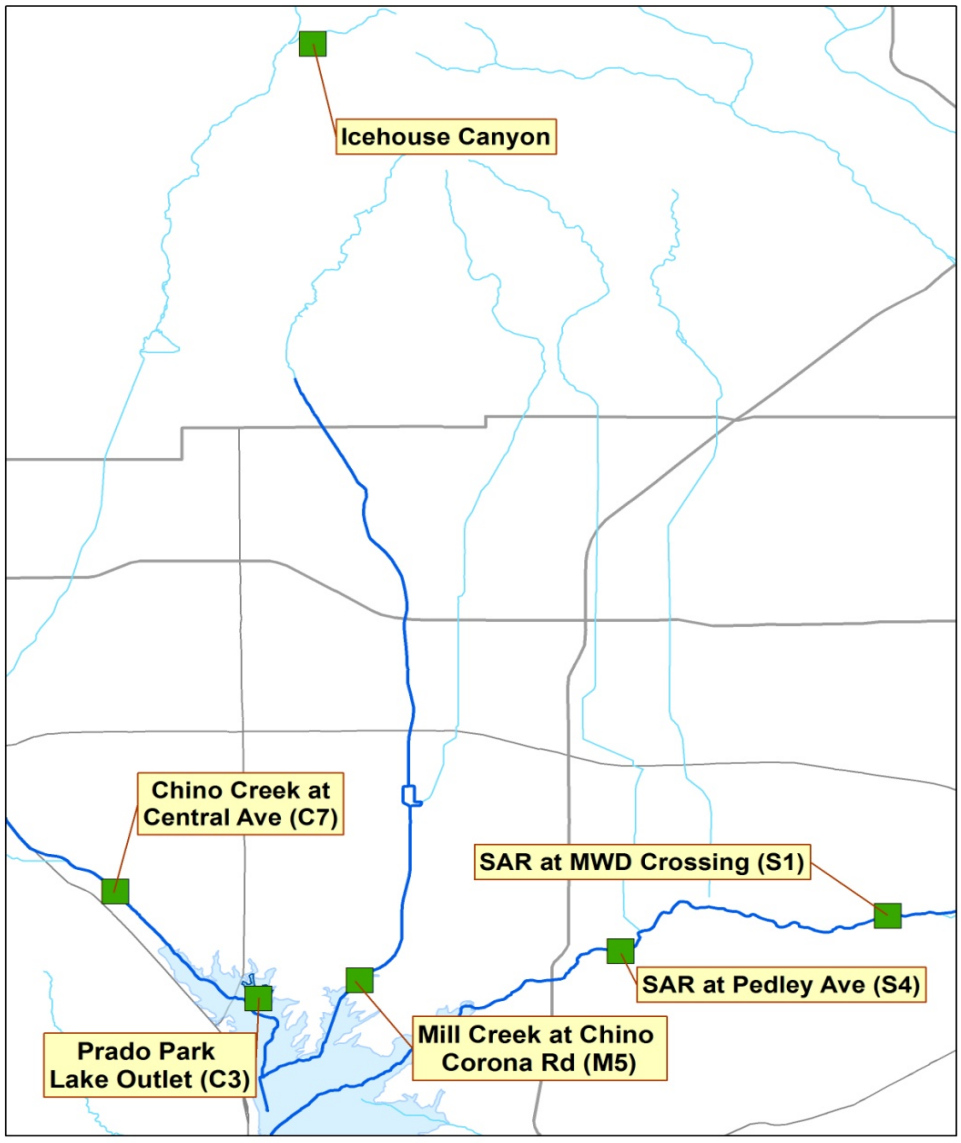



**Figure 2-1. Location of watershed-wide compliance monitoring program sample locations in the Middle Santa Ana River watershed**

## 2.2 Sampling Methods

The RWQCB-approved Monitoring Plan and QAPP (SAWPA 2008a, b) provide detailed information regarding the collection and analysis of field data and water quality samples. The following sections provide a summary of these methods.

### 2.2.1 Water Quality Measurements

At each sample site water quality measurements include the collection of field parameter data and water samples for laboratory analysis:

- *Field Measurements*: Flow, temperature, conductivity, pH, dissolved oxygen, and turbidity.
- *Laboratory Analysis*: Fecal coliform, *E. coli*, and total suspended solids (TSS).

### 2.2.2 Sample Frequency

The Monitoring Plan established sample collection dates for each year of the monitoring program. These are summarized as follows:

- *2007 Dry Season* - Weekly samples were collected over a 15 week period from July 9, 2007 to the week ending October 14, 2007. Table 2-2 summarizes the results of this effort.

**Table 2-2. Summary of water sample collection activity during 2007 dry season**

| Sample Month | Planned | Collected | Site Dry | Samples Missed (Cause) |
|---|---|---|---|---|
| July | 24 | 20 | 4[1] | 0 |
| August | 24 | 20 | 4[1] | 0 |
| September | 24 | 20 | 4[1] | 0 |
| October | 18 | 15 | 3[1] | 0 |

[1] Icehouse Canyon was dry – no sample collected

- *2008 Dry Season* – Sampling began as scheduled the week of May 13th. However, laboratory contract problems, which prevented the laboratory from accepting samples for analysis, resulted in the suspension of sampling for a six week period from the week of July 20, 2008 through the end of August 2008. Once the contract issues were resolved, weekly sample collection resumed the week of September 1, 2008. To ensure the collection of 20 warm, dry season samples in 2008, the TMDL Task Force agreed to extend the sample period into the first week of November 2008. Table 2-3 summarizes the results of the 2008 dry season sampling effort.
- *2009 Dry Season* - Weekly samples were collected over a 20 week period from the week ending May 30, 2009 to the week ending October 10, 2009. Table 2-4 summarizes the results of this sampling effort.

**Table 2-3. Summary of water sample collection activity during 2008 dry season**

| Sample Month | Planned | Collected | Site Dry | Samples Missed (Cause) |
|---|---|---|---|---|
| May | 18 | 17 | 0 | 1 (road closure in Icehouse Canyon due to fire) |
| June | 24 | 24 | 0 | 0 |
| July[1] | 18 | 18 | 0 | 0 |
| August[2] | 0 | 0 | 0 | 0 |
| September | 27 | 27 | 0 | 0 |
| October | 27 | 27 | 0 | 0 |
| November | 6 | 6 | 0 | 0 |

[1] Sample program suspended for six weeks during months of July and August (see text for discussion)

**Table 2-4. Summary of water sample collection activity during 2009 dry season**

| Sample Month | Planned | Collected | Samples Missed |
|---|---|---|---|
| May | 5 | 5 | 0 |
| June | 25 | 25 | 0 |
| July | 20 | 20 | 0 |
| August | 20 | 20 | 0 |
| September | 25 | 25 | 0 |
| October | 5 | 5 | 0 |

- *2007-2008 Wet Season* - Weekly samples were collected over a 10 week period from the week ending December 22, 2007 to the week ending February 23, 2008. In addition, one storm event was sampled. Storm event sampling includes: (1) collection of a sample on the day of the storm event; (2) collection of additional samples at 48, 72 and 96 hours after the onset if the storm event. During this wet season a storm event was sampled on December 7, 2007. Additional samples were collected 48, 72 and 96 hours after the storm event on December 9th, 10th and 11th, respectively. Table 2-5 summarizes the results of the 2007-2008 wet season sampling effort.

- *2008-2009 Wet Season* - Weekly samples collected over an 11 week period from the week ending December 13, 2008 to the week ending February 21, 2009. During the 2008-2009 sampling period, a storm event was sampled on December 15th, 2008. Additional samples were collected 48, 72 and 96 hours after the storm event on December 17th, 18th and 19th, respectively. Table 2-6 summarizes the results of the 2008-2009 wet season sampling effort.

### 2.2.3 Sample Collection

San Bernardino County Flood Control District staff collected the field measurements and water quality samples. CDM coordinated the activities of the sample team and the submittal of samples to the laboratory for analysis.

**Table 2-5. Summary of water sample collection activity during 2007-2008 wet season**

| Sample Month | Planned | Collected | Site Dry | Samples Missed (Cause) |
|---|---|---|---|---|
| **Weekly Sampling** | | | | |
| December | 12 | 10 | 2[2] | 0 |
| January | 30 | 25 | 5[2] | 0 |
| February | 18 | 15 | 3[2] | 0 |
| **Storm Event Sampling** | | | | |
| December 7 - 11 | 24 | 20 | 4[2] | 0 |

[1] Wet weather event occurred on December 7th
[2] Icehouse Canyon was dry – no sample collected

**Table 2-6. Summary of water sample collection activity during 2008-2009 wet season**

| Sample Month | Planned | Collected | Site Dry | Samples Missed (Cause) |
|---|---|---|---|---|
| **Weekly Sampling** | | | | |
| December | 24 | 24[1] | 0 | 0 |
| January | 24 | 24 | 0 | 0 |
| February | 18 | 18 | 0 | 0 |
| **Storm Event Sampling** | | | | |
| December 15 -19 | 24 | 24 | 0 | 0 |

[1] Collection of weekly samples planned for week of December 15 coincided with collection of samples during the first day of a storm event. Accordingly, the first day storm event sample represented the regular weekly sampling event.

### 2.2.4 Sample Handling

Sample collection and laboratory delivery followed approved chain of custody procedures, holding time requirements, and required storage procedures for each water quality analysis. The Orange County Health Care Agency Water Quality Laboratory conducted all analyses for fecal coliform, *E. coli*, and TSS.

## 2.3 Data Management

The following sections describe data handling and analysis methods. Additional details are provided in the Monitoring Plan and QAPP (see footnote 2).

### 2.3.1 Data Handling

CDM and SAWPA maintain a file of all laboratory and field data records (e.g., data sheets, chain of custody forms) as required by the QAPP. CDM entered all field measurements and laboratory analysis results into a project database that is compatible with guidelines and formats established by the California Surface Water Ambient Monitoring Program. CDM periodically submits to SAWPA updates of this for incorporation into the Santa Ana Watershed Data Management System (SAWDMS), which SAWPA manages. Prior to a data submittal to SAWPA, CDM completes a quality assurance/quality control review of the data.

### 2.3.2 Data Analysis

Data analysis relied primarily on the use of descriptive statistics and comparisons to water quality objectives or TMDL allocations. For any statistical analyses, the bacterial indicator data were assumed to be log-normally distributed as was observed in previous studies (SAWPA 2009a). Accordingly, prior to conducting statistical analyses, the bacterial indicator data were log transformed.

# Section 3
# Compliance with Wasteload Allocations

The TMDL contains WLAs for urban discharges and CAFOs. The watershed-wide compliance monitoring program samples five locations on a regular basis. These sites evaluate compliance with WLAs. Source specific monitoring, i.e., urban discharge vs. CAFO discharge does not occur at this time. The following sections summarize the FIB concentrations observed at the watershed-wide compliance sites during the last three years.

## 3.1 Bacterial Indicator Concentrations

The following tables summarize the observed FIB*i* concentrations at each of the watershed-wide compliance sites during the dry and wet season sample periods from 2007-2009:

- Table 3-1 summarizes observations for both dry and wet seasons from summer 2007 to spring 2008.
- Table 3-2 summarizes the observations during the dry season of 2008.
- Table 3-3 summarizes the observations during the wet season of 2008-2009.
- Table 3-4 summarizes the observations during the dry season of 2009.

Tables 3-5 and 3-6 summarize the geometric mean, median, and coefficient of variation of the fecal coliform data for samples collected during each dry and wet weather season. Data from Icehouse Canyon was not included because the site was either often dry or the results were below laboratory detection.

Tables 3-7 and 3-8 summarize the geometric mean, median, and coefficient of variation of the *E. coli* data for samples collected during each dry and wet weather season. Data from Icehouse Canyon was not included because the site was either often dry or the results were below laboratory detection.

Figures 3-1 to 3-5 illustrate the trend in single sample and geometric mean results for fecal coliform for the 2007-2009 period for all sites except Icehouse Canyon. Figures 3-6 to 3-10 illustrate the same for *E. coli*.

Figure 3-11 illustrates the variability of bacterial indicator concentrations observed during the 2007-2009 period for both dry and wet seasons. Superimposed on this figure are the individual wet weather event sample results. These sample results tend to be higher than the median FIB concentrations.

**Table 3-1. Fecal coliform and *E. coli* (cfu/100 mL) concentrations observed at watershed-wide compliance sites during 2007-2008**

| Sample Week | Fecal coliform | | | | | | *E. coli* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Icehouse Canyon (WW-C1) | Prado Park Lake (WW-C3) | Chino Creek (WW-C7) | Mill Creek (WW-M5) | Santa Ana River @ MWD Crossing (WW-S1) | Santa Ana River @ Pedley Avenue (WW-S4) | Icehouse Canyon (WW-C1) | Prado Park Lake (WW-C3) | Chino Creek (WW-C7) | Mill Creek (WW-M5) | Santa Ana River @ MWD Crossing (WW-S1) | Santa Ana River @ Pedley Avenue (WW-S4) |
| **2007 Dry Season** | | | | | | | | | | | | |
| 7/8/07 | NS[1] | 30 | 5,200 | 5,200 | 170 | 150 | NS[1] | 30 | 1,210 | 2,000 | 30 | 40 |
| 7/15/07 | NS[1] | 9 | 3,000 | 2,600 | 270 | 220 | NS[1] | < 9 | 810 | > 1,000 | 290 | 60 |
| 7/22/07 | NS[1] | 60 | 5,900 | > 9,000 | 220 | 2,300 | NS[1] | 60 | > 2,700 | > 5,700 | 99 | 150 |
| 7/29/07 | NS[1] | > 340 | 2,000 | > 1,600 | 700 | > 240 | NS[1] | 230 | 560 | 1,170 | 70 | 140 |
| 8/5/07 | NS[1] | 210 | 1,500 | 2,700 | 210 | 550 | NS[1] | 110 | 940 | > 1,150 | 140 | 110 |
| 8/12/07 | NS[1] | 300 | 2,400 | 2,200 | 420 | 560 | NS[1] | 170 | 420 | 720 | 280 | 140 |
| 8/19/07 | NS[1] | 440 | 1,100 | 2,800 | 3,100 | 1,100 | NS[1] | 440 | > 1,030 | > 750 | > 490 | 150 |
| 8/26/07 | NS[1] | 99 | > 2,400 | > 1,300 | > 900 | 1,110 | NS[1] | 30 | 770 | 780 | 220 | 280 |
| 9/2/07 | NS[1] | 140 | 1,800 | > 1,500 | 2,600 | 18,000 | NS[1] | 150 | 870 | 550 | 960 | 2,800 |
| 9/9/07 | NS[1] | 50 | > 720 | > 2,300 | 1,800 | 2,200 | NS[1] | 30 | > 720 | > 1,150 | 170 | 180 |
| 9/16/07 | NS[1] | 820 | 1,100 | > 1,500 | 310 | 510 | NS[1] | 990 | > 330 | > 760 | 170 | 170 |
| 9/23/07 | NS[1] | 40 | 6,000 | 4,200 | 4,900 | 3,400 | NS[1] | 50 | > 800 | > 700 | > 380 | > 310 |
| 9/30/07 | NS[1] | 200 | 510 | 1,700 | 600 | 430 | NS[1] | 140 | 320 | 730 | 200 | 140 |
| 10/7/07 | NS[1] | 140 | 440 | 480 | 280 | 220 | NS[1] | 180 | 260 | 500 | 220 | 200 |
| 10/14/07 | NS[1] | 70 | > 700 | 2,400 | 110 | 470 | NS[1] | 40 | 440 | 910 | 360 | 480 |
| **2007-08 Wet Season** | | | | | | | | | | | | |
| 12/16/07 | NS[1] | 380 | 80 | 730 | 2,200 | 2,600 | NS[1] | 260 | 120 | 1,500 | 3,800 | 4,600 |
| 12/23/07 | NS[1] | 210 | 320 | 170 | 120 | 80 | NS[1] | 170 | 240 | 150 | 120 | 130 |
| 12/30/07 | NS[1] | 180 | 230 | 180 | 40 | 60 | NS[1] | 200 | 210 | 200 | 130 | 70 |
| 1/6/08 | NS[1] | 80 | 310 | 480 | 160 | 520 | NS[1] | 120 | 220 | 360 | 140 | 490 |
| 1/13/08 | NS[1] | 80 | 200 | 180 | 50 | 80 | NS[1] | 110 | 260 | 100 | 40 | 70 |
| 1/20/08 | NS[1] | 50 | 4,100 | 230 | 40 | 9 | NS[1] | 60 | 2,100 | 200 | 30 | 50 |
| 1/27/0/ | NS[1] | 520 | 210 | 340 | 180 | 390 | NS[1] | 470 | 260 | 360 | 190 | 260 |
| 2/3/08 | NS[1] | 280 | 70 | 160 | 120 | 90 | NS[1] | 250 | 110 | 50 | 40 | 30 |
| 2/10/08 | NS[1] | 130 | 130 | 70 | 40 | 40 | NS[1] | 90 | 50 | 110 | 40 | 80 |
| 2/17/08 | NS[1] | 60 | 150 | 7,700 | 60 | 140 | NS[1] | 80 | 150 | 5,200 | 40 | 80 |

**Table 3-1. Fecal coliform and *E. coli* (cfu/100 mL) concentrations observed at watershed-wide compliance sites during 2007-2008**

| Sample Week | Fecal coliform | | | | | | *E. coli* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Icehouse Canyon (WW-C1) | Prado Park Lake (WW-C3) | Chino Creek (WW-C7) | Mill Creek (WW-M5) | Santa Ana River @ MWD Crossing (WW-S1) | Santa Ana River @ Pedley Avenue (WW-S4) | Icehouse Canyon (WW-C1) | Prado Park Lake (WW-C3) | Chino Creek (WW-C7) | Mill Creek (WW-M5) | Santa Ana River @ MWD Crossing (WW-S1) | Santa Ana River @ Pedley Avenue (WW-S4) |
| **Wet Weather Event** | | | | | | | | | | | | |
| 12/7/07 | NS[1] | 260 | 10,000 | 22,000 | 43,000 | 9,000 | NS[1] | 160 | 5,100 | > 5,000 | 22,000 | 7,200 |
| 12/9/07 | NS[1] | 130 | 3,100 | 790 | 420 | 2,000 | NS[1] | 90 | 2,200 | 520 | 310 | 780 |
| 12/10/07 | NS[1] | 90 | 230 | 200 | 190 | 190 | NS[1] | 120 | 200 | 130 | 110 | 120 |
| 12/11/07 | NS[1] | 99 | 240 | | 210 | 190 | NS[1] | 90 | 230 | 120 | 120 | 170 |

[1] – No sample, site dry

**Table 3-2. Fecal coliform and *E. coli* concentrations (cfu/100 ml) observed at watershed-wide compliance sites during the 2008 dry season**

| Sample Date (Week of) | Icehouse Canyon (WW-C1) | Prado Park Lake Outlet (WW-C3) | Chino Creek @ Central Avenue (WW-C7) | Mill Creek @ Chino-Corona Rd (WW-M5) | SAR @ MWD Crossing (WW-S1) | SAR @ Pedley Avenue (WW-S4) |
|---|---|---|---|---|---|---|
| **Fecal coliform** | | | | | | |
| May 13 | No Sample (Dry) | 99 | 280 | 1,000 | 340 | 180 |
| May 20 | < 9 | 60 | 200 | 540 | 110 | 40 |
| May 27 | < 9 | 60 | 590 | 3,500 | 500 | 690 |
| June 3 | < 9 | 90 | 470 | 3,000 | 820 | 670 |
| June 10 | < 9 | 30 | 3,200 | 1,140 | 390 | 380 |
| June 17 | < 9 | 40 | 1,000 | 1,400 | 90 | 280 |
| June 24 | < 9 | > 400 | 2,700 | 1,400 | 580 | 3,900 |
| July 1 | < 9 | 490 | 580 | 1,300 | 340 | 240 |
| July 8 | < 9 | 420 | 560 | 5,900 | 380 | 210 |
| July 15 | < 9 | 70 | 9,600 | > 3,400 | 230 | 190 |
| September 2 | < 9 | 290 | 8,100 | 1,600 | 350 | 2,300 |
| September 9 | 30 | 170 | 2,400 | 590 | 280 | 320 |
| September 16 | 40 | > 500 | 3,800 | 380 | 190 | 210 |
| September 23 | 20 | 230 | 850 | 2,800 | 50 | 140 |
| September 30 | < 9 | 260 | 560 | 490 | 220 | 60 |
| October 7 | < 9 | 200 | 380 | 40 | 130 | 110 |
| October 14 | < 9 | 200 | 210 | 18,000 | 150 | 70 |
| October 21 | < 9 | 160 | 920 | 1,700 | 70 | 90 |
| October 28 | < 9 | 110 | 230 | 420 | 140 | 160 |
| November 4 | < 9 | 180 | 36,000 | 3,800 | 2,700 | 5,600 |
| ***E. coli*** | | | | | | |
| May 13 | No Sample (Dry) | 100 | 350 | 1,260 | 470 | 110 |
| May 20 | < 9 | 40 | 210 | 590 | 160 | 90 |
| May 27 | < 9 | 80 | 320 | 700 | 270 | 200 |
| June 3 | < 9 | 20 | 500 | 1,180 | > 160 | > 200 |

**Table 3-2. Fecal coliform and *E. coli* concentrations (cfu/100 ml) observed at watershed-wide compliance sites during the 2008 dry season**

| Sample Date (Week of) | Icehouse Canyon (WW-C1) | Prado Park Lake Outlet (WW-C3) | Chino Creek @ Central Avenue (WW-C7) | Mill Creek @ Chino-Corona Rd (WW-M5) | SAR @ MWD Crossing (WW-S1) | SAR @ Pedley Avenue (WW-S4) |
|---|---|---|---|---|---|---|
| June 10 | < 9 | 70 | 610 | 1,030 | 150 | 370 |
| June 17 | < 9 | 90 | 310 | 1,240 | 110 | 310 |
| June 24 | < 9 | 340 | 440 | 810 | 180 | 170 |
| July 1 | < 9 | 670 | 480 | 620 | 180 | 140 |
| July 8 | < 9 | 360 | 310 | 8,700 | 200 | 130 |
| July 15 | < 9 | 140 | 1,610 | 1,100 | 40 | 70 |
| September 2 | < 9 | 160 | 850 | 790 | 180 | 690 |
| September 9 | 40 | 50 | 1,000 | 540 | 140 | 190 |
| September 16 | 30 | 350 | 1,130 | 730 | 130 | 90 |
| September 23 | 30 | 230 | 710 | 2,100 | 80 | 40 |
| September 30 | < 9 | 240 | 620 | 720 | 150 | 90 |
| October 7 | < 9 | 240 | 320 | 140 | 60 | 150 |
| October 14 | < 9 | 220 | 260 | 2,800 | 120 | 90 |
| October 21 | < 9 | 50 | 210 | 420 | 90 | 140 |
| October 28 | < 9 | 40 | 230 | 340 | 200 | 320 |
| November 4 | < 9 | 99 | 33,000 | 440 | 340 | 620 |

**Table 3-3. Fecal coliform and *E. coli* concentrations (cfu/100 mL) observed at watershed-wide compliance sites during the 2008-2009 wet season**

| Bacterial Indicator | Sample Date (Week of) | Icehouse Canyon Creek (WW-C1) | Prado Park Lake Outlet (WW-C3) | Chino Creek @ Central Avenue (WW-C7) | Mill Creek @ Chino-Corona Rd (WW-M5) | SAR @ MWD Crossing (WW-S1) | SAR @ Pedley Avenue (WW-S4) |
|---|---|---|---|---|---|---|---|
| Fecal coliform | **Regular Sample Events** | | | | | | |
| | December 8 | < 9 | 410 | 5,800 | 900 | 170 | 150 |
| | December 15[1] | < 90 | 1,700 | 4,300 | 4,800 | 2,400 | 4,200 |
| | December 22 | < 9 | 40 | 410 | 200 | 210 | 320 |
| | December 29 | < 9 | 60 | 160 | 180 | 99 | 99 |
| | January 5 | < 9 | 40 | 190 | 530 | 20 | 40 |
| | January 12 | < 9 | 120 | 190 | 380 | 30 | 70 |
| | January 19 | < 9 | 99 | 640 | 850 | 20 | 50 |
| | January 26 | < 9 | 220 | 350 | 380 | 80 | 99 |
| | February 2 | 9 | 40 | 220 | 390 | 40 | 50 |
| | February 9 | < 9 | 2,100 | 220 | 280 | 70 | 80 |
| | February 16 | < 9 | 10,500 | 4,800 | 450 | 330 | 330 |
| | **Storm Event Samples** | | | | | | |
| | December 15[1] | < 90 | 1,700 | 4,300 | 4,800 | 2,400 | 4,200 |
| | December 17 | 20 | 480 | 10,300 | 1,700 | 3,700 | 4,700 |
| | December 18 | < 9 | 400 | 3,100 | 5,900 | 3,800 | 3,900 |
| | December 19 | < 9 | 40 | 290 | 140 | 650 | 1,300 |
| *E. coli* | **Regular Sample Events** | | | | | | |
| | December 8 | < 9 | 510 | 12,900 | 970 | 90 | 260 |
| | December 15[1] | < 90 | 2,000 | 5,700 | 7,200 | 1,700 | 3,800 |
| | December 22 | < 9 | 80 | 2,100 | 210 | 210 | 340 |
| | December 29 | < 9 | 100 | 210 | 270 | 60 | 60 |
| | January 5 | < 9 | 110 | 30 | 640 | 30 | 9 |
| | January 12 | < 9 | 90 | 150 | 390 | 40 | 40 |
| | January 19 | < 9 | 120 | 510 | 660 | < 9 | 120 |
| | January 26 | < 9 | 310 | 320 | 390 | 110 | 120 |
| | February 2 | 9 | 40 | 160 | 580 | 20 | 80 |

**Table 3-3. Fecal coliform and *E. coli* concentrations (cfu/100 mL) observed at watershed-wide compliance sites during the 2008-2009 wet season**

| Bacterial Indicator | Sample Date (Week of) | Icehouse Canyon Creek (WW-C1) | Prado Park Lake Outlet (WW-C3) | Chino Creek @ Central Avenue (WW-C7) | Mill Creek @ Chino-Corona Rd (WW-M5) | SAR @ MWD Crossing (WW-S1) | SAR @ Pedley Avenue (WW-S4) |
|---|---|---|---|---|---|---|---|
| *E. coli* | February 9 | < 9 | 2,700 | 280 | 380 | 60 | 70 |
| | February 16 | < 9 | 15,000 | 6,200 | 500 | 220 | 340 |
| | **Storm Event Samples** | | | | | | |
| | December 15[1] | < 90 | 2,000 | 5,700 | 7,200 | 1,700 | 3,800 |
| | December 17 | 9 | 290 | 7,600 | 1,400 | 1,400 | 2,500 |
| | December 18 | < 9 | 600 | 2,500 | 4,200 | 3,400 | 4,600 |
| | December 19 | < 9 | 260 | 390 | 590 | 880 | 2,400 |

[1] First storm event sample coincided with regular weekly sample date and represent the same sample

**Table 3-4. Fecal coliform and *E. coli* concentrations (cfu/100 mL) observed at watershed-wide compliance sites during the 2009 dry season**

| Sample Week | Prado Park Lake Outlet (WW-C3) | Chino Creek @ Central Avenue (WW-C7) | Mill-Cucamonga Creek @ Chino-Corona Rd (WW-M5) | SAR @ MWD Crossing (WW-S1) | SAR @ Pedley Avenue (WW-S4) |
|---|---|---|---|---|---|
| **Fecal coliform** | | | | | |
| May 25 | 120 | 210 | 150 | 120 | 99 |
| June 1 | 40 | 70 | 210 | 80 | 50 |
| June 8 | 140 | 220 | 540 | 40 | 140 |
| June 15 | 140 | 170 | 480 | 140 | 90 |
| June 22 | 20 | 220 | 290 | 99 | 120 |
| June 29 | 90 | 280 | 350 | 80 | 99 |
| July 6 | 40 | 1,100 | 300 | 140 | 120 |
| July 13 | < 9 | 1,600 | >= 220 | 120 | 160 |
| July 20 | 40 | 250 | 280 | 150 | 170 |
| July 27 | 80 | 320 | 1,500 | 160 | 220 |
| August 3 | 70 | 280 | 280 | 120 | 220 |
| August 10 | 99 | >= 520 | >= 560 | 170 | 140 |
| August 17 | 250 | 200 | 270 | 130 | 140 |
| August 24 | 200 | >= 230 | 4300 | 140 | 90 |
| August 31 | >= 180 | 2200 | 500 | 240 | 460 |
| September 7 | 120 | >= 240 | >= 450 | 99 | 230 |
| September 14 | >= 110 | 1000 | 3000 | 150 | 180 |
| September 21 | >= 790 | >= 460 | >= 840 | 110 | 90 |
| September 28 | 150 | 250 | 850 | 180 | 220 |
| October 5 | 80 | 210 | 580 | 70 | 200 |
| ***E. coli*** | | | | | |
| May 25 | 180 | 180 | 320 | 100 | 140 |
| June 1 | 80 | 40 | 490 | 40 | 40 |
| June 8 | 90 | 230 | 620 | 80 | 110 |
| June 15 | 90 | 140 | 830 | 140 | 100 |

**Table 3-4. Fecal coliform and *E. coli* concentrations (cfu/100 mL) observed at watershed-wide compliance sites during the 2009 dry season**

| Sample Week | Prado Park Lake Outlet (WW-C3) | Chino Creek @ Central Avenue (WW-C7) | Mill-Cucamonga Creek @ Chino-Corona Rd (WW-M5) | SAR @ MWD Crossing (WW-S1) | SAR @ Pedley Avenue (WW-S4) |
|---|---|---|---|---|---|
| June 22 | 50 | 80 | 330 | 140 | 130 |
| June 29 | 50 | 130 | 410 | 90 | 99 |
| July 6 | 40 | 190 | 570 | 60 | 140 |
| July 13 | 9 | 270 | 370 | 140 | 70 |
| July 20 | 9 | 160 | 520 | 80 | 130 |
| July 27 | 40 | 280 | 2,300 | 140 | 90 |
| August 3 | 50 | 210 | 540 | 140 | 120 |
| August 10 | 9 | 350 | 982 | 110 | 140 |
| August 17 | 50 | 230 | 620 | 120 | 130 |
| August 24 | 80 | >= 410 | 4,600 | 320 | >= 240 |
| August 31 | >= 50 | 740 | 1,350 | >= 220 | >= 210 |
| September 7 | 110 | 370 | 950 | 180 | 210 |
| September 14 | >= 50 | 360 | 2,900 | 220 | 150 |
| September 21 | >= 730 | 220 | 700 | 210 | 120 |
| September 28 | 40 | 140 | 690 | 110 | 140 |
| October 5 | 30 | 110 | 620 | 100 | 110 |

**Table 3-5. Summary of fecal coliform concentrations (cfu/100 mL) and data variability by sample location during the 2007, 2008 and 2009 dry seasons (2007-2008 data from Icehouse Canyon were not included because the site was often dry or values were below detection)**

| Site | 2009 | | | | 2008 | | | | 2007 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Geometric Mean | Median | Coefficient of Variation[1] | N | Geometric Mean | Median | Coefficient of Variation[1] | N | Geometric Mean | Median | Coefficient of Variation[1] |
| Prado Park Lake | 20 | 91 | 105 | 0.21 | 20 | 152 | 175 | 0.17 | 15 | 114 | 140 | 0.25 |
| Chino Creek | 20 | 339 | 250 | 0.14 | 20 | 1,116 | 720 | 0.20 | 15 | 1,678 | 1,800 | 0.11 |
| Mill-Cucamonga Creek | 20 | 505 | 405 | 0.14 | 20 | 1,334 | 1,400 | 0.18 | 15 | 2,240 | 2,300 | 0.09 |
| SAR @ MWD Crossing | 20 | 119 | 125 | 0.08 | 20 | 232 | 225 | 0.18 | 15 | 572 | 420 | 0.18 |
| SAR @ Pedley Ave. | 20 | 144 | 140 | 0.10 | 20 | 306 | 225 | 0.22 | 15 | 773 | 550 | 0.19 |

[1] - Coefficient of variation was calculated using natural log-transformed data

**Table 3-6. Summary of *E. coli* concentrations (cfu/100 mL) and data variability by sample location during the 2007, 2008, and 2009 dry seasons (2007-2008 data from Icehouse Canyon were not included because the site was often dry or values were below detection)**

| Site | 2009 | | | | 2008 | | | | 2007 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Geometric Mean | Median | Coefficient of Variation[1] | N | Geometric Mean | Median | Coefficient of Variation[1] | N | Geometric Mean | Median | Coefficient of Variation[1] |
| Prado Park Lake | 20 | 51 | 50 | 0.26 | 20 | 124 | 120 | 0.19 | 15 | 90 | 110 | 0.27 |
| Chino Creek | 20 | 202 | 215 | 0.12 | 20 | 570 | 460 | 0.18 | 15 | 676 | 770 | 0.09 |
| Mill-Cucamonga Creek | 20 | 764 | 620 | 0.11 | 20 | 855 | 760 | 0.13 | 15 | 979 | 780 | 0.09 |
| SAR @ MWD Crossing | 20 | 123 | 130 | 0.08 | 20 | 148 | 155 | 0.14 | 15 | 204 | 220 | 0.18 |
| SAR @ Pedley Ave. | 20 | 123 | 130 | 0.10 | 20 | 162 | 145 | 0.11 | 15 | 187 | 150 | 0.19 |

[1] - Coefficient of variation was calculated using natural log-transformed data

**Table 3-7. Summary of fecal coliform concentrations (cfu/100 mL) and data variability by sample location during the 2007-2008 and 2008-2009 wet seasons (2007-2008 data from Icehouse Canyon were not included because the site was often dry or values were below detection)**

| Site | 2008-2009 | | | | 2007-2008 | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Geometric Mean | Median | Coefficient of Variation[1] | N | Geometric Mean | Median | Coefficient of Variation[1] |
| Prado Park Lake | 14 | 230 | 170 | 0.32 | 14 | 144 | 130 | 0.14 |
| Chino Creek | 14 | 776 | 380 | 0.23 | 14 | 365 | 230 | 0.26 |
| Mill Creek | 14 | 595 | 420 | 0.18 | 14 | 431 | 215 | 0.26 |
| SAR @ MWD Crossing | 14 | 188 | 135 | 0.35 | 14 | 196 | 140 | 0.36 |
| SAR @ Pedley Ave. | 14 | 266 | 125 | 0.32 | 14 | 219 | 165 | 0.34 |

[1] - Coefficient of variation was calculated using natural log-transformed data

**Table 3-8. Summary of *E. coli* concentrations (cfu/100 mL) and data variability by sample location during the 2007-2008 and 2008-2009 wet seasons (2007-2008 data from Icehouse Canyon were not included because the site was often dry or values were below detection)**

| Site | 2008-2009 | | | | 2007-2008 | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Geometric Mean | Median | Coefficient of Variation[1] | N | Geometric Mean | Median | Coefficient of Variation[1] |
| Prado Park Lake | 14 | 335 | 275 | 0.28 | 14 | 138 | 120 | 0.11 |
| Chino Creek | 14 | 806 | 450 | 0.27 | 14 | 311 | 225 | 0.23 |
| Mill Creek | 14 | 718 | 585 | 0.15 | 14 | 323 | 200 | 0.25 |
| SAR @ MWD Crossing | 14 | 148 | 100 | 0.35 | 14 | 165 | 120 | 0.36 |
| SAR @ Pedley Ave. | 14 | 257 | 190 | 0.32 | 14 | 214 | 125 | 0.34 |

[1] - Coefficient of variation was calculated using natural log-transformed data

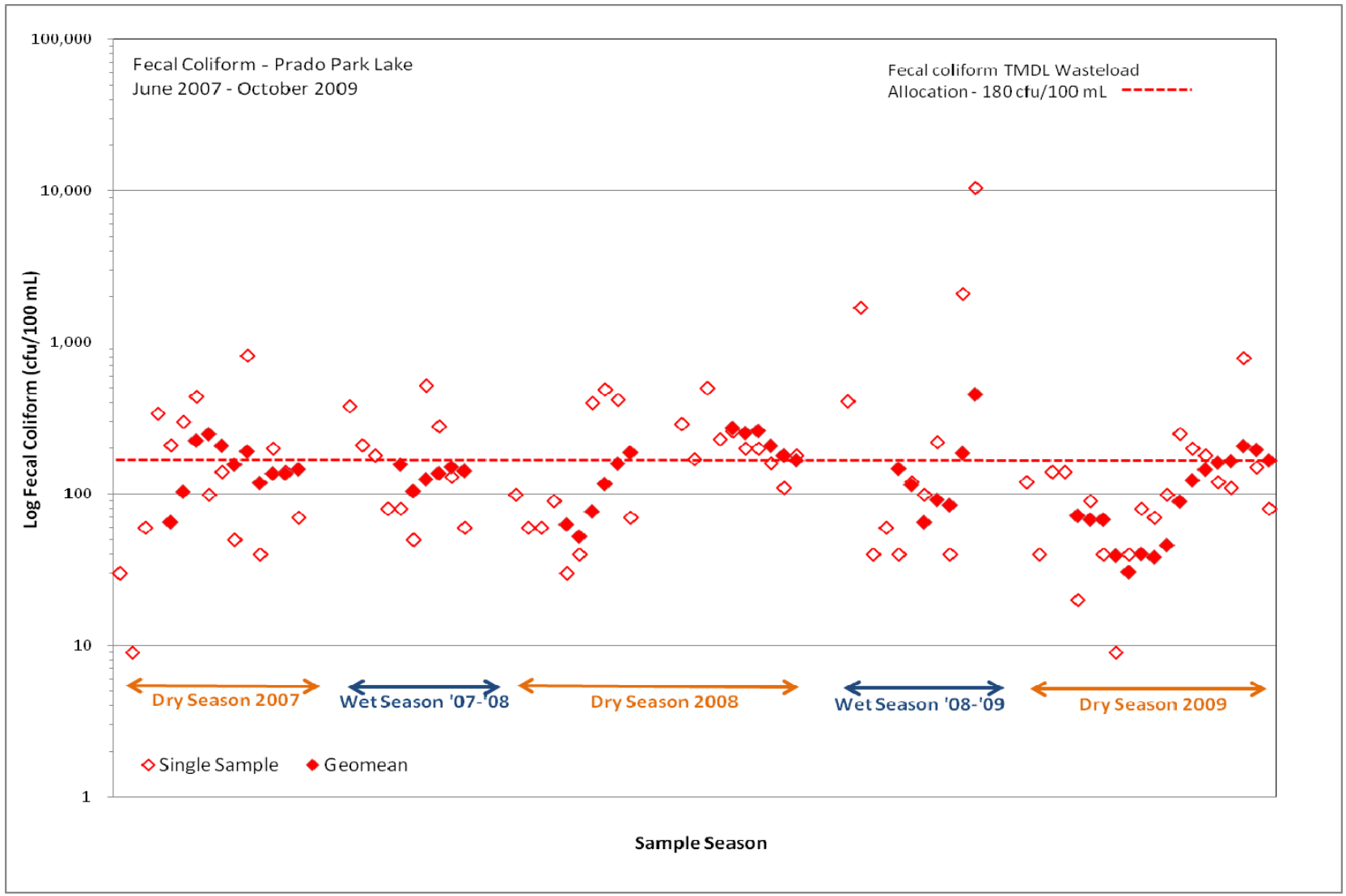



**Figure 3-1. Time series plot of fecal coliform single sample results and geometric means for samples collected from Prado Park Lake (2007-2009). Geometric mean was calculated only if five samples were collected during the previous five weeks.**

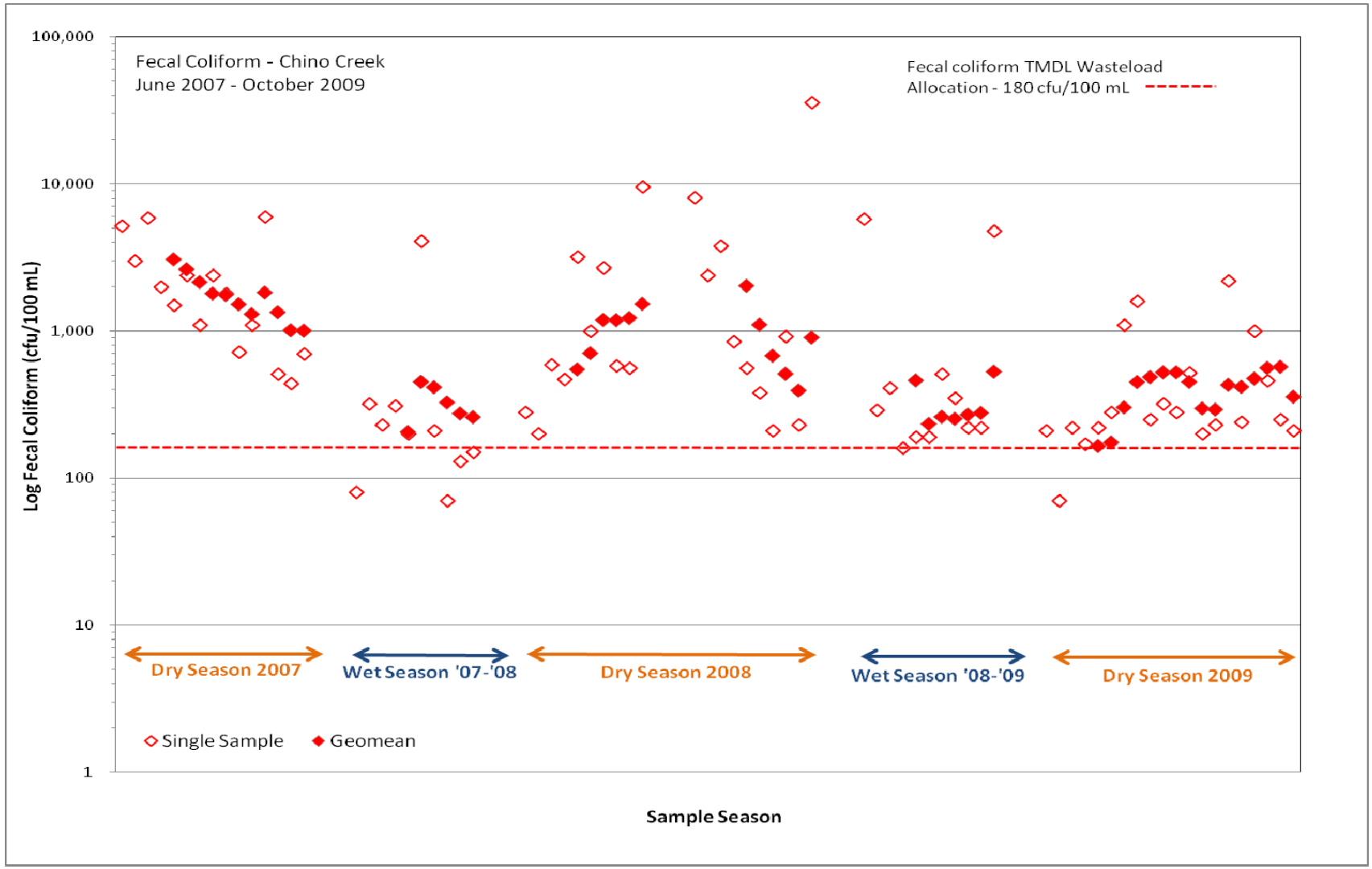



**Figure 3-2. Time series plot of fecal coliform single sample results and geometric means for samples collected from Chino Creek (2007-2009). Geometric mean was calculated only if five samples were collected during the previous five weeks.**

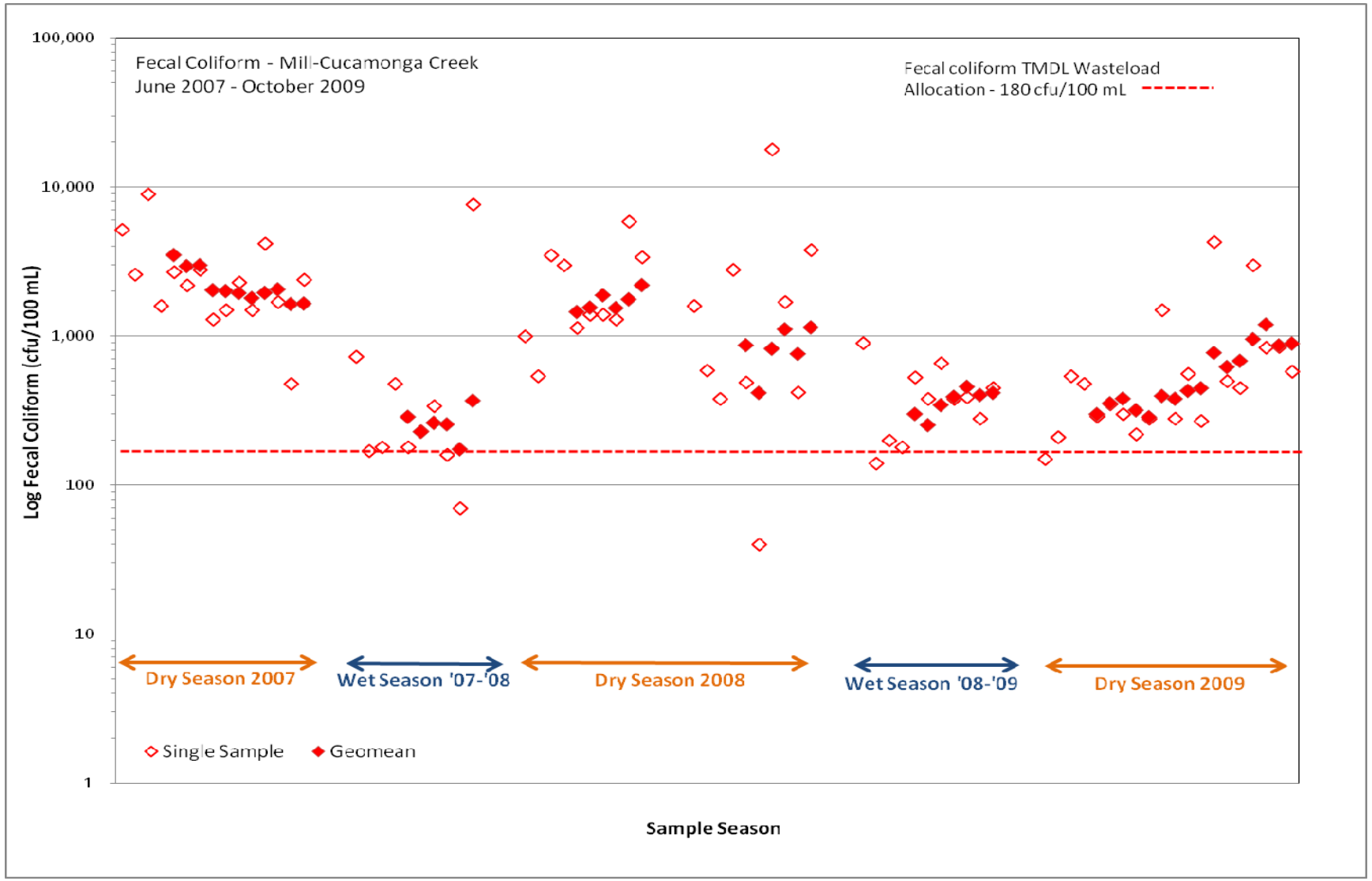



**Figure 3-3. Time series plot of fecal coliform single sample results and geometric means for samples collected from Mill-Cucamonga Creek (2007-2009). Geometric mean was calculated only if five samples were collected during the previous five weeks.**

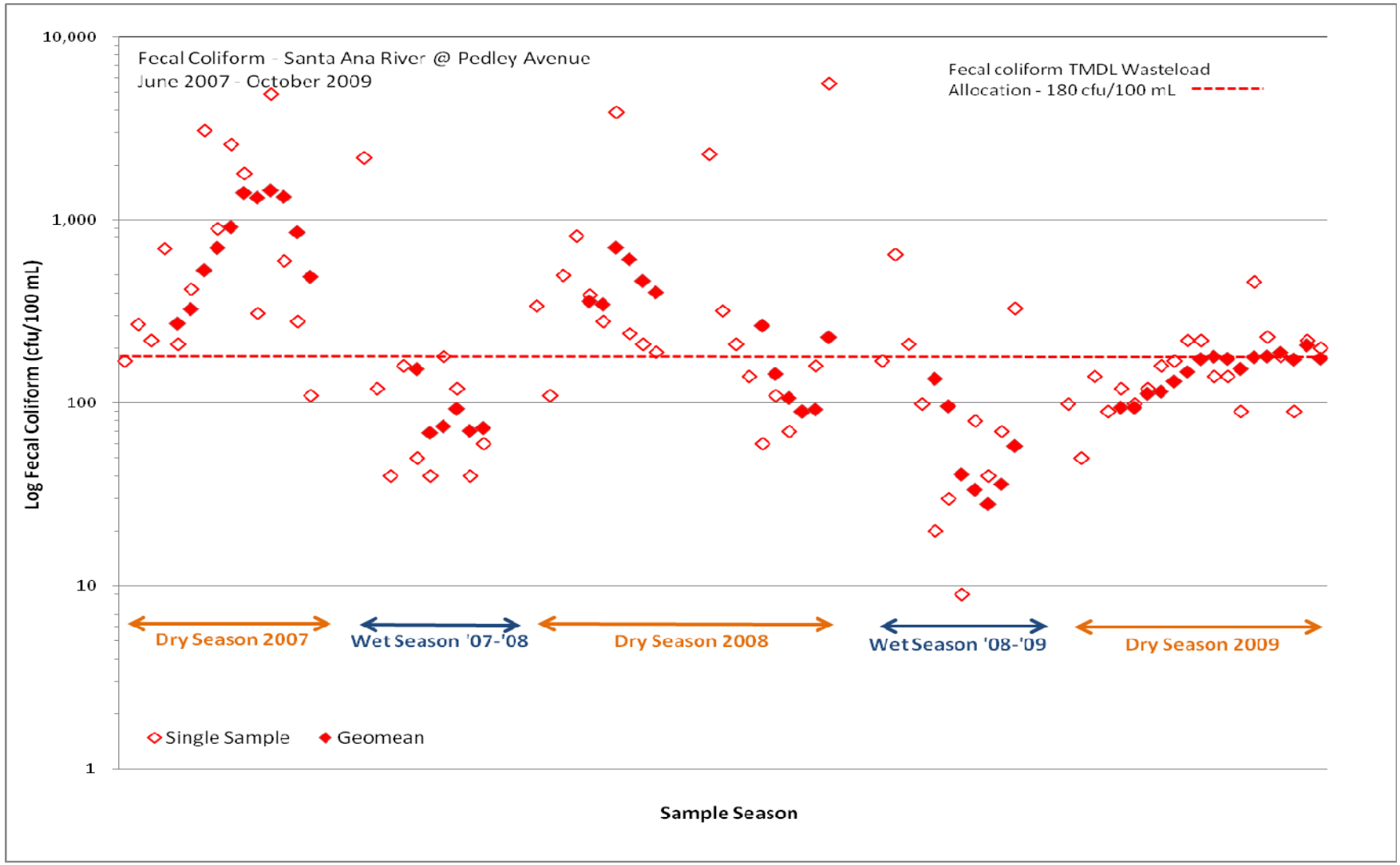



**Figure 3-4. Time series plot of fecal coliform single sample results and geometric means for samples collected from Santa Ana River @ Pedley Avenue (2007-2009). Geometric mean was calculated only if five samples were collected during the previous five weeks.**

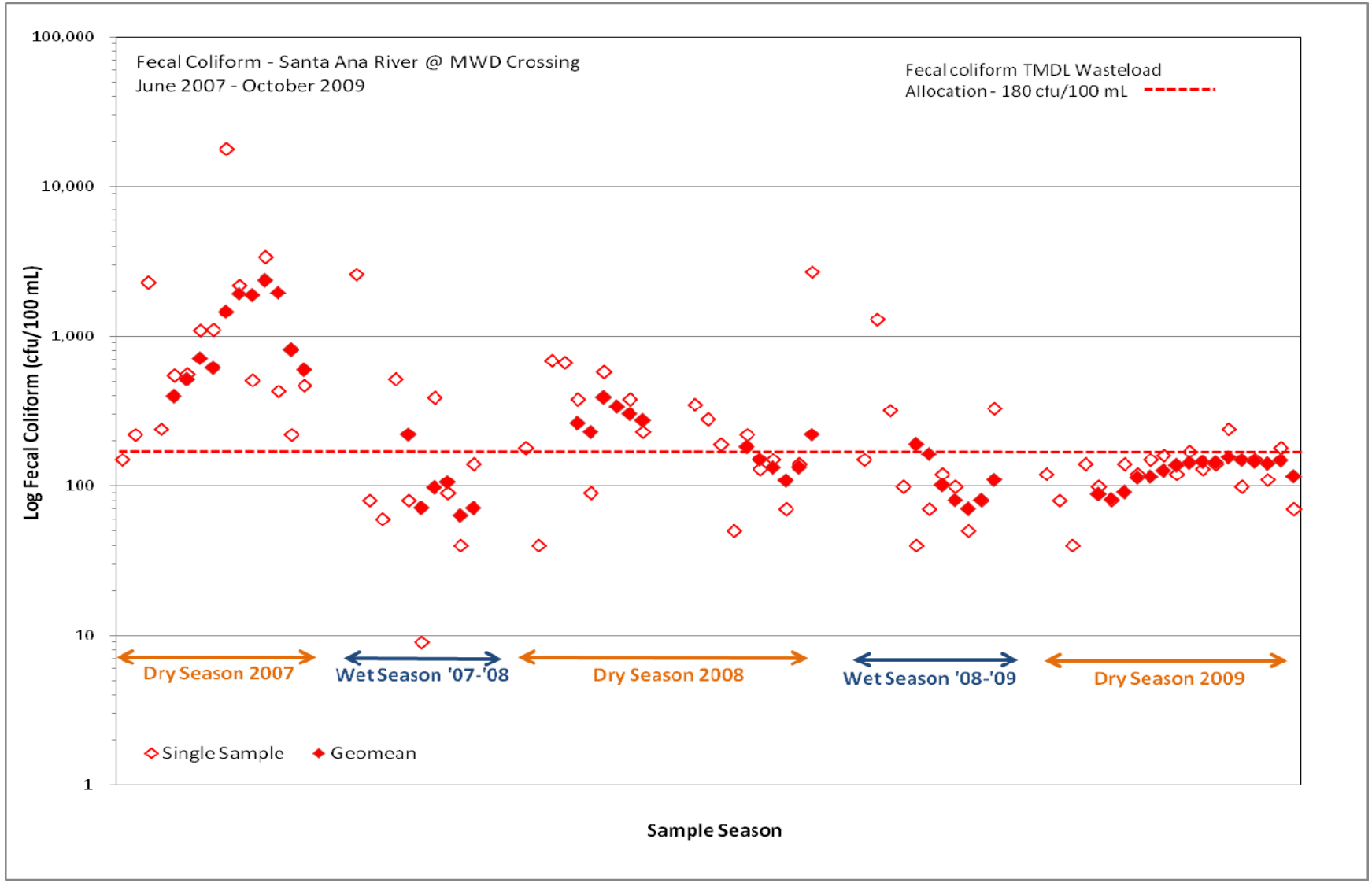



**Figure 3-5. Time series plot of fecal coliform single sample results and geometric means for samples collected from Santa Ana River @ MWD Crossing (2007-2009). Geometric mean was calculated only if five samples were collected during the previous five weeks.**

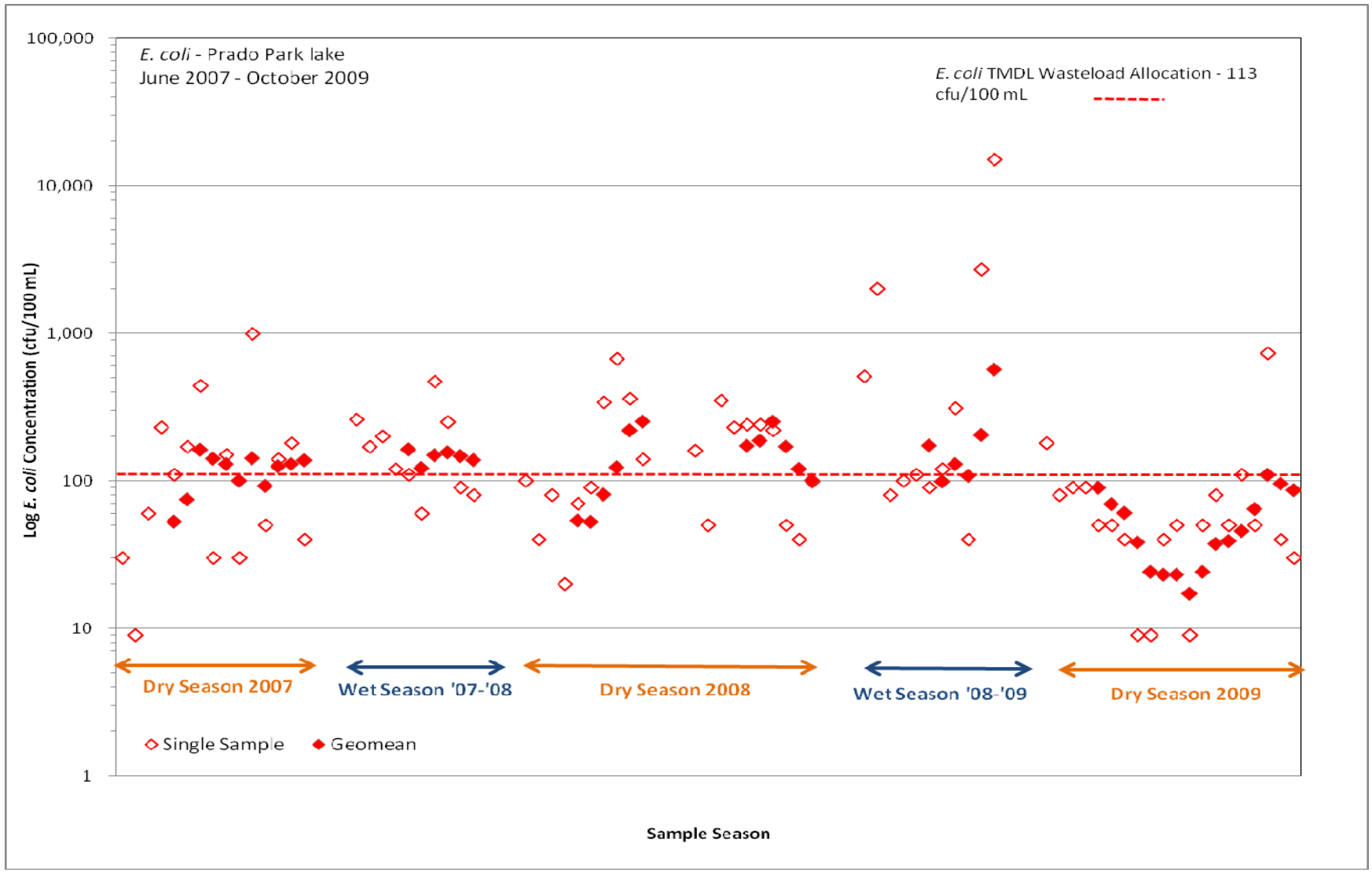



**Figure 3-6. Time series plot of *E. coli* single sample results and geometric means for samples collected from Prado Park Lake (2007-2009). Geometric mean was calculated only if five samples were collected during the previous five weeks.**

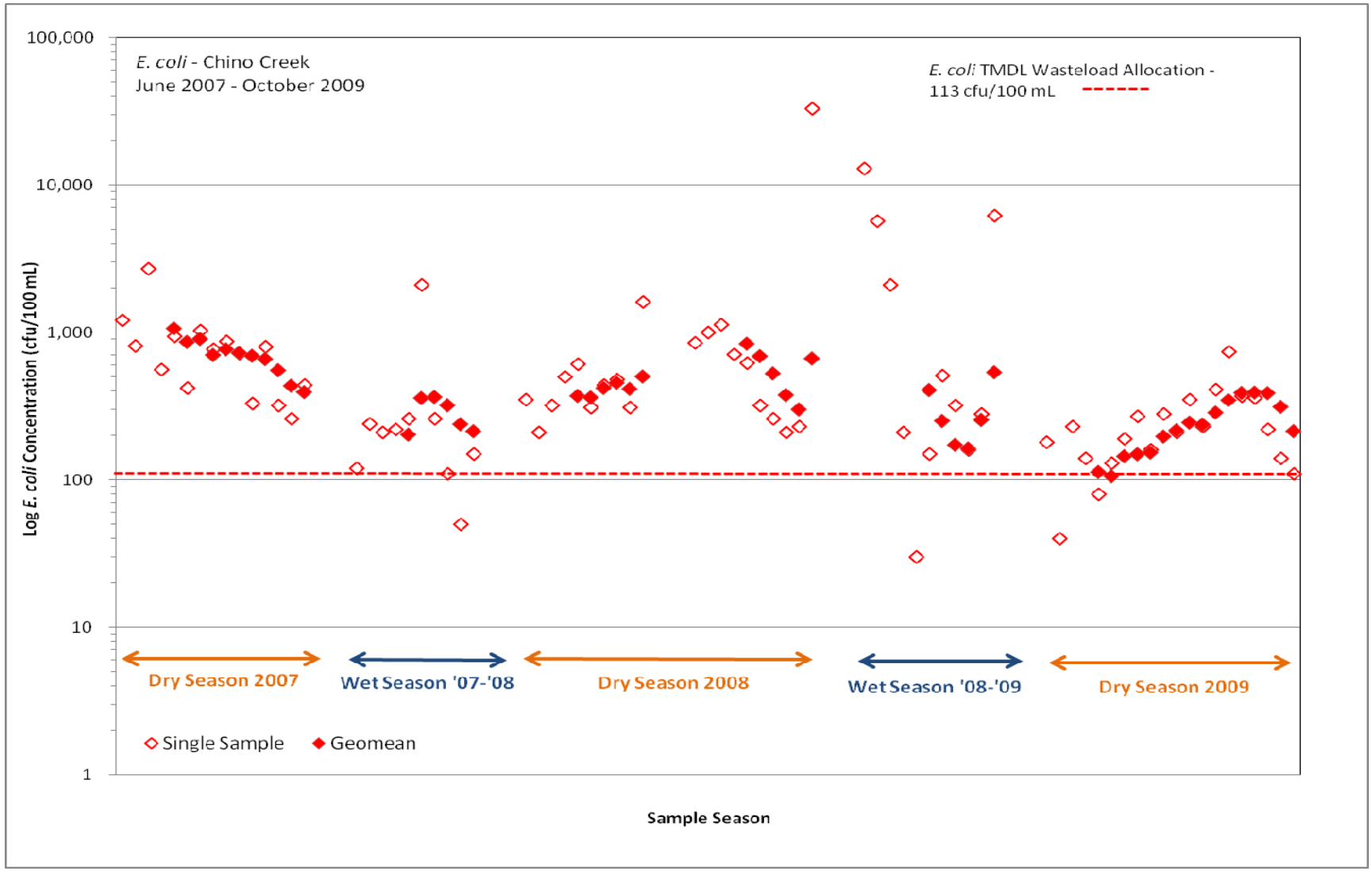



**Figure 3-7. Time series plot of *E. coli* single sample results and geometric means for samples collected from Chino Creek (2007-2009). Geometric mean was calculated only if five samples were collected during the previous five weeks.**

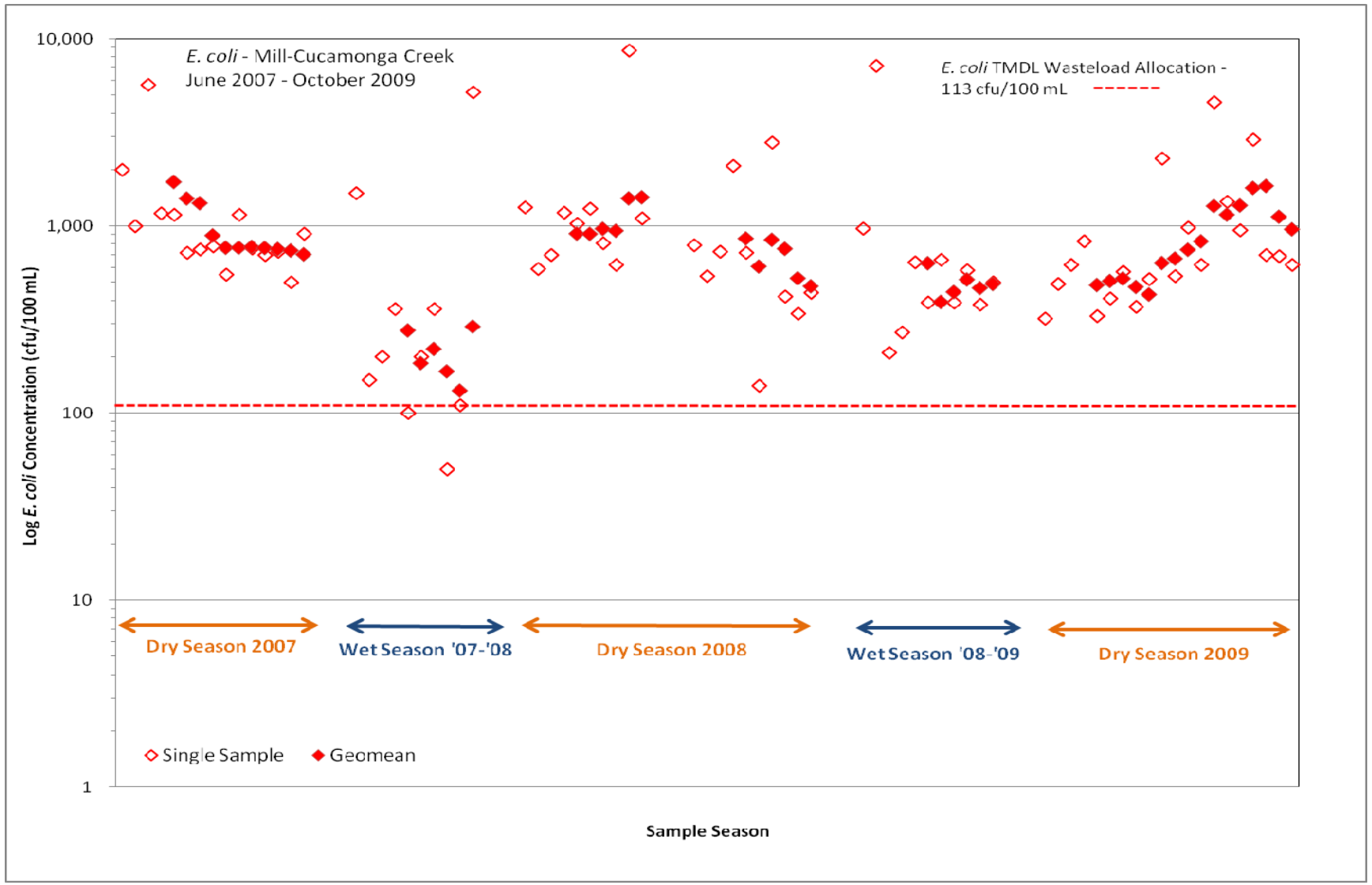



**Figure 3-8. Time series plot of *E. coli* single sample results and geometric means for samples collected from Mill-Cucamonga Creek (2007-2009). Geometric mean was calculated only if five samples were collected during the previous five weeks.**

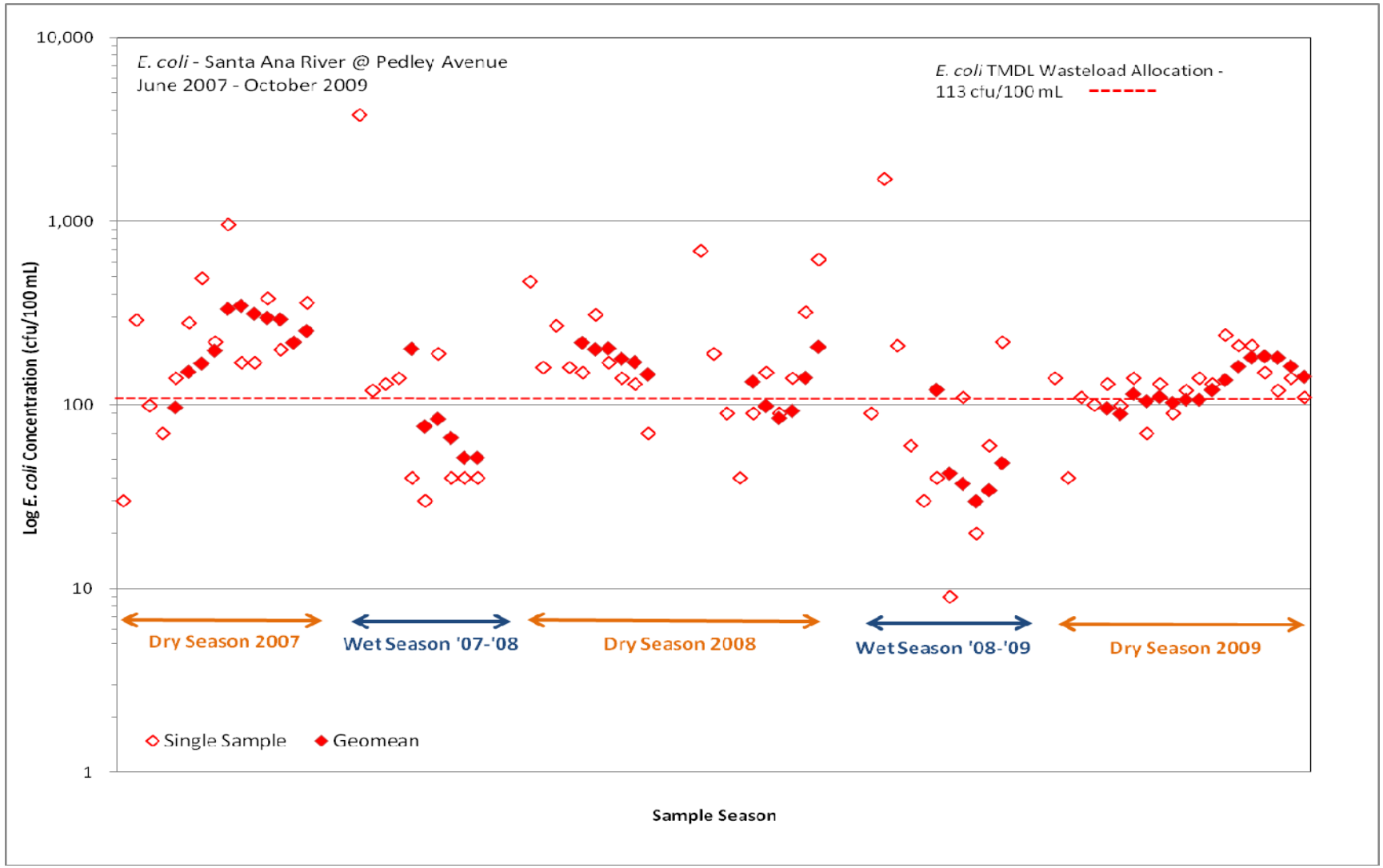



**Figure 3-9. Time series plot of *E. coli* single sample results and geometric means for samples collected from Santa Ana River @ Pedley Avenue (2007-2009). Geometric mean was calculated only if five samples were collected during the previous five weeks.**

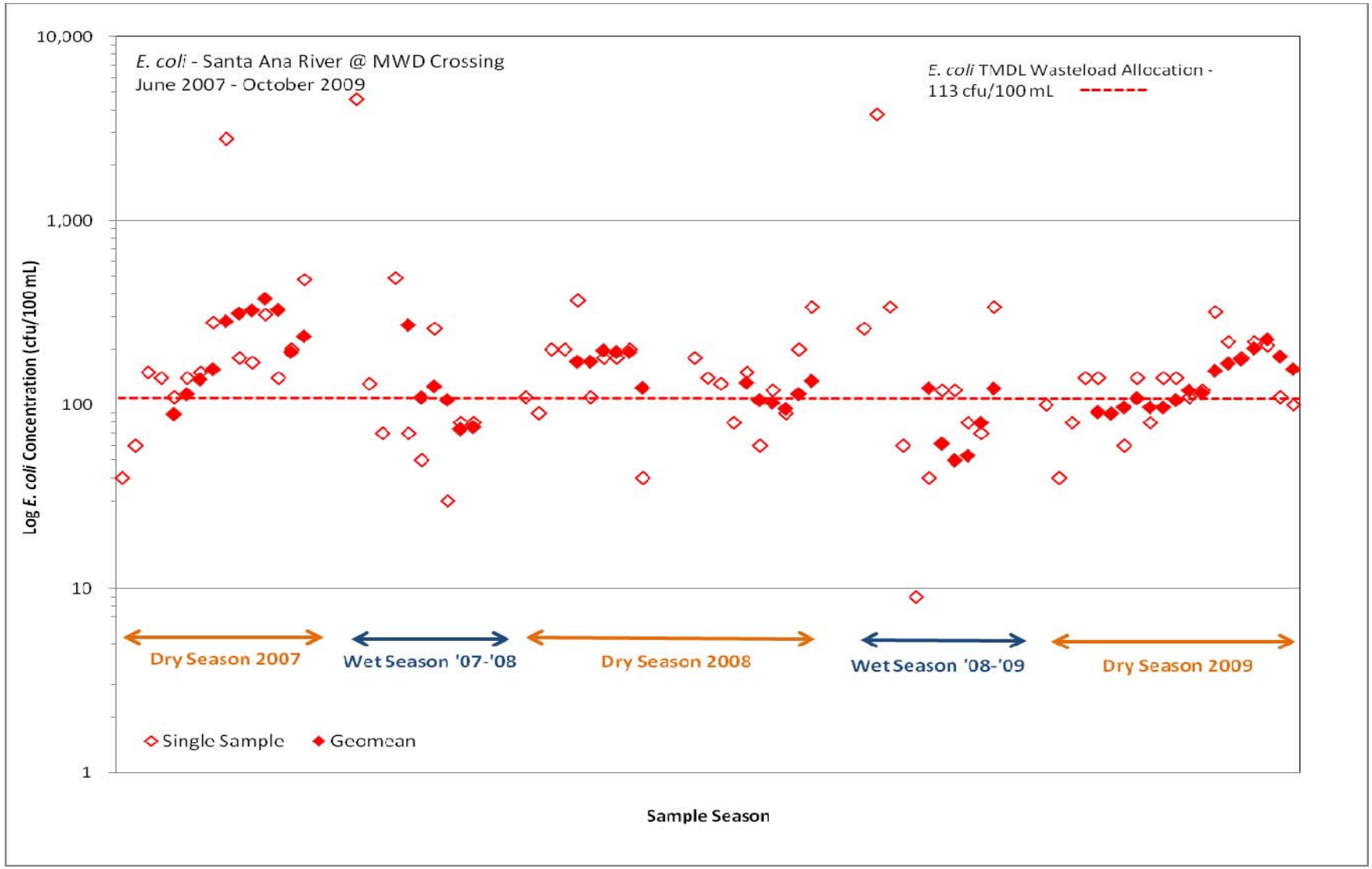



**Figure 3-10. Time series plot of *E. coli* single sample results and geometric means for samples collected from Santa Ana River @ MWD Crossing (2007-2009). Geometric mean was calculated only if five samples were collected during the previous five weeks.**

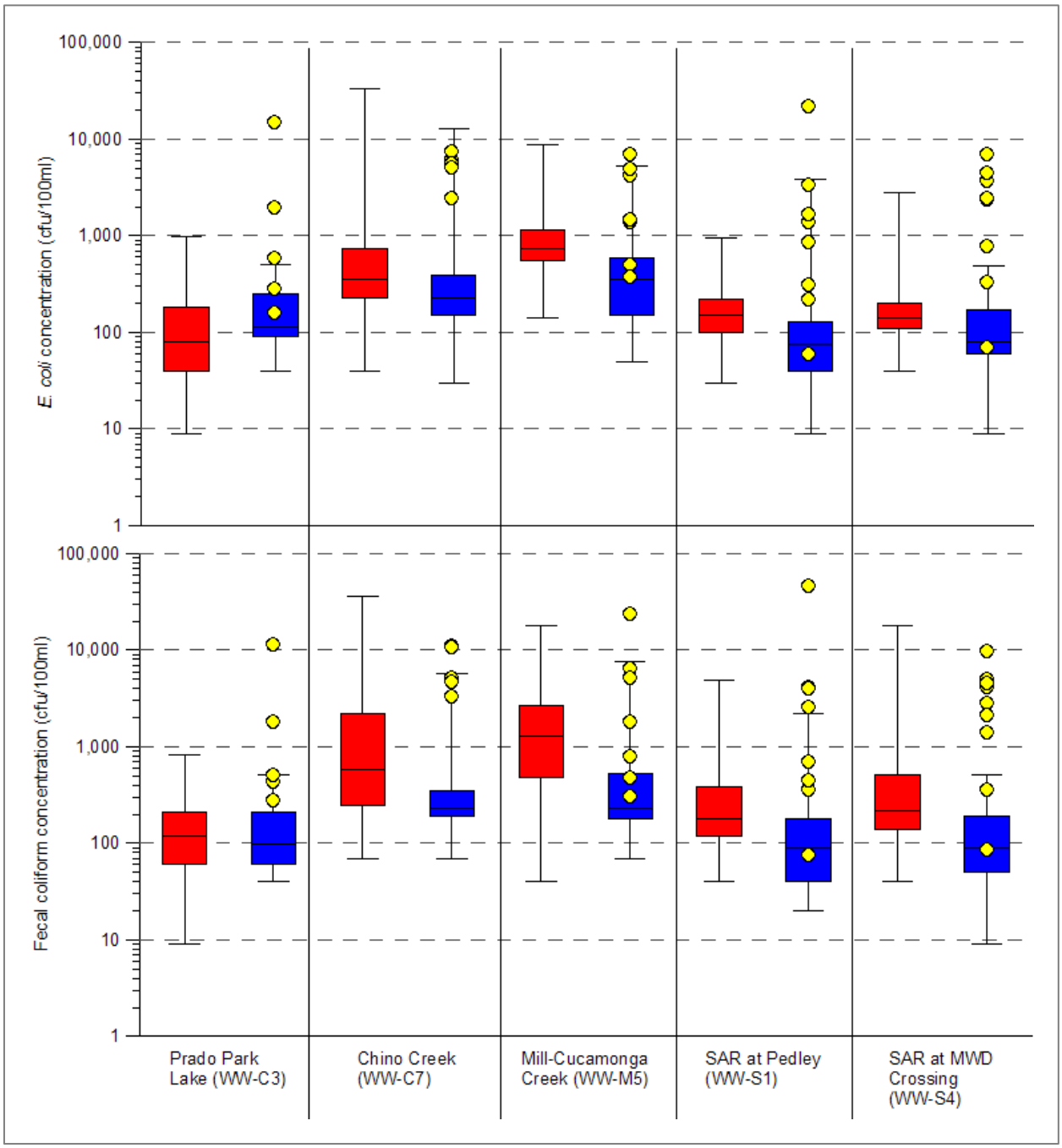



**Figure 3-11. Box-whisker plots of bacteria indicator concentrations from 2007-2009 during dry weather in the dry season (red) and wet season (blue), and wet weather events (yellow points).**

In general, the observed overall dry season geometric mean FIB concentrations at each watershed-wide compliance site have declined over the period from 2007-2009 (Figures 3-12 and 3-13). Concentrations at Prado Park Lake have been below the fecal coliform WLA throughout the period; with the exception of 2008, *E. coli* concentrations have also been below the WLA. In 2009, the dry season geometric mean observed for fecal coliform was below the WLAs at both Santa Ana River sites; *E. coli* met the water quality objective, but was above the WLA. Although a general decline in geometric means occurred at the Chino Creek and Mill-Cucamonga Creeek sites, bacterial indicator concentrations remain well above the WLAs.

Figures 3-14 and 3-15 illustrate the wet season geometric mean for fecal coliform and *E. coli*, respectively. The geometric mean calculations include the storm event data collected during each wet season. In general, the observed wet season geometric mean FIB concentrations at each watershed-wide compliance site were greater in 2008-2009 than in 2007-2008. This difference is influenced to some degree by the concentrations observed during the storm event. With the exception of Prado Park Lake (which met the WLA for fecal coliform in 2007-2008), no site met the WLA for either fecal coliform or *E. coli* for either wet season period.

## 3.2 Compliance Frequency

Tables 3-9 and 3-10 summarize the frequency of compliance with single sample and geometric mean Basin Plan water quality objectives for fecal coliform (single sample maximum: 400 cfu/mL; geometric mean: 200 cfu/mL) and proposed water quality objectives for *E. coli* (single sample maximum: 235 cfu/mL; geometric mean: 126 cfu/mL) during the dry seasons of 2007, 2008 and 2009. In general, the frequency of compliance with single sample criteria has improved during the dry season between 2007 and 2009. Improvements in compliance with geometric criteria have been observed at Prado Park Lake and both Santa Ana River sites. However, this is not the case at the Chino Creek and Mill-Cucamonga Creek sites.

Tables 3-11 and 3-12 summarize the frequency of compliance with single sample and geometric mean Basin Plan water quality objectives for fecal coliform (single sample maximum: 400 cfu/mL; geometric mean: 200 cfu/mL) and proposed water quality objectives for *E. coli* (single sample maximum: 235 cfu/mL; geometric mean: 126 cfu/mL) during the wet seasons of 2007-2008 and 2008-2009. For the single sample data, the compliance frequency was calculated separately for dry and wet weather samples. Compliance with fecal coliform objectives was generally better during the 2008-2009 season than the 2007-2008 season – even during wet weather. Differences occurred between sample seasons with regards to compliance with proposed *E. coli* objectives; however, no particular trend was evident.

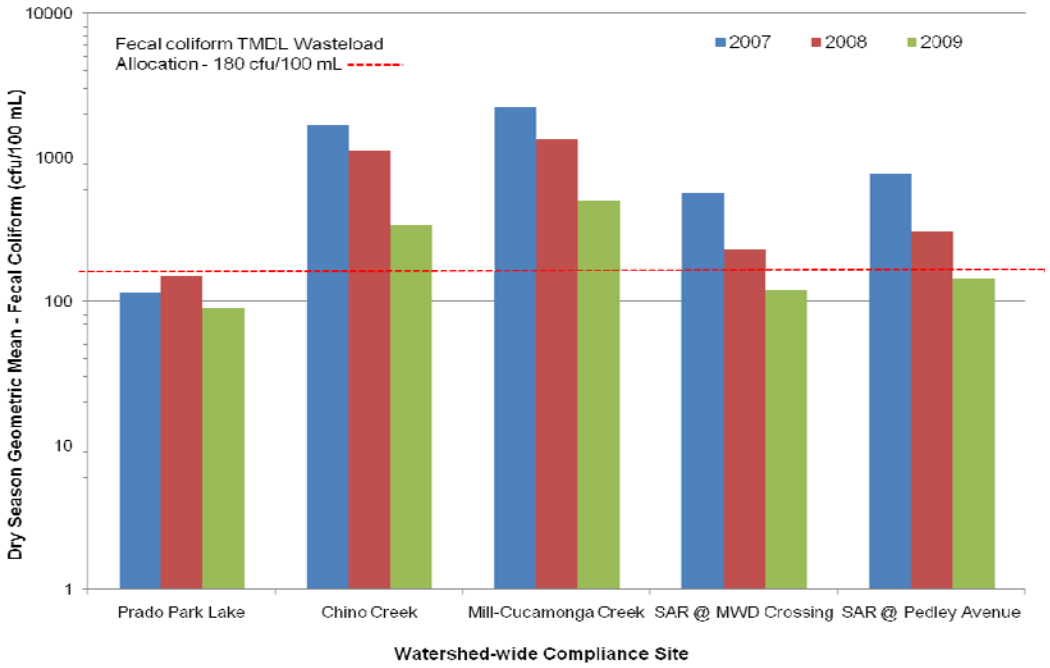



**Figure 3-12. Change in dry season fecal coliform geometric means for 2007-2009.**

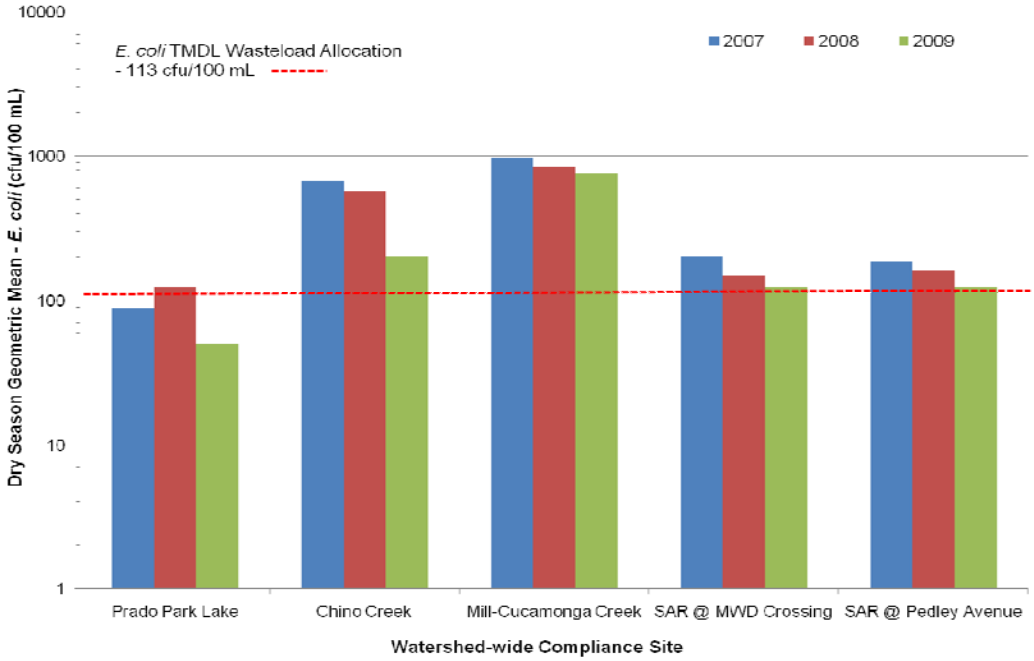
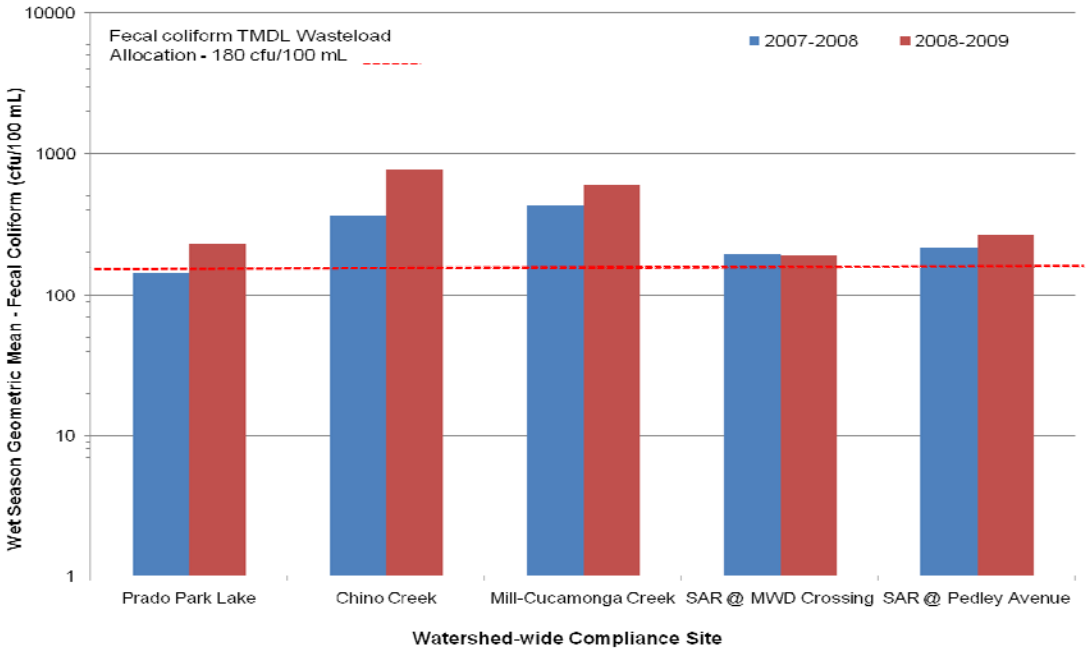



**Figure 3-13. Change in dry season *E. coli* geometric means for 2007-2009.**



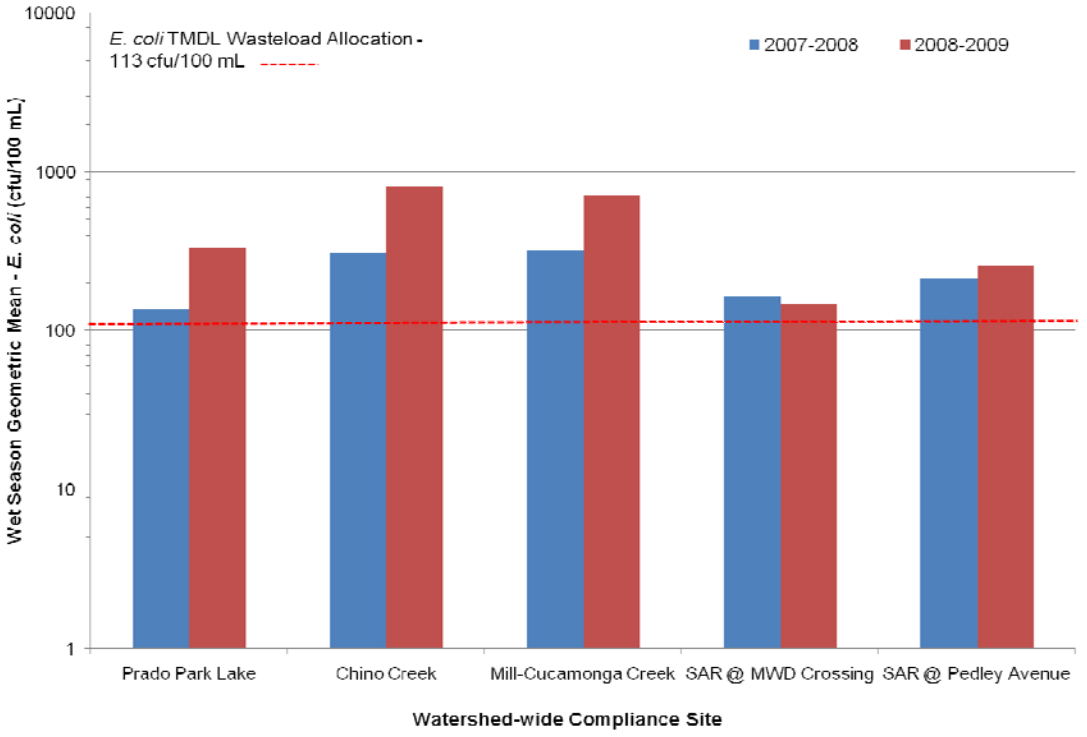




**Figure 3-15. Change in wet season *E. coli* geometric means for 2007-2009.**

**Table 3-9. Compliance frequency for fecal coliform during the 2007, 2008, and 2009 dry seasons (as compared to existing Basin Plan objectives for fecal coliform)**

| Site | Single Sample Criterion Exceedance Frequency (%) | | | Geometric Mean Criterion Exceedance Frequency (%) | | |
|---|---|---|---|---|---|---|
| | 2007 | 2008 | 2009 | 2007 | 2008 | 2009 |
| Prado Park Lake | 13% | 15% | 5% | 27% | 33% | 6% |
| Chino Creek | 100% | 75% | 35% | 100% | 100% | 88% |
| Mill-Cucamonga Creek | 100% | 90% | 55% | 100% | 100% | 100% |
| SAR @ MWD Crossing | 53% | 20% | 5% | 82% | 58% | 6% |
| SAR @ Pedley Ave. | 73% | 25% | 0% | 91% | 67% | 0% |

**Table 3-10. Compliance frequency for *E. coli* during the 2007, 2008, and 2009 dry seasons (as compared to proposed Basin Plan objectives for *E. coli*)**

| Site | Single Sample Criterion Exceedance Frequency (%) | | | Geometric Mean Criterion Exceedance Frequency (%) | | |
|---|---|---|---|---|---|---|
| | 2007 | 2008 | 2009 | 2007 | 2008 | 2009 |
| Prado Park Lake | 20% | 30% | 5% | 64% | 50% | 0% |
| Chino Creek | 100% | 85% | 35% | 100% | 100% | 88% |
| Mill-Cucamonga Creek | 100% | 95% | 100% | 100% | 100% | 100% |
| SAR @ MWD Crossing | 40% | 15% | 5% | 91% | 58% | 44% |
| SAR @ Pedley Ave. | 27% | 25% | 5% | 82% | 75% | 44% |

**Table 3-11. Compliance frequency for fecal coliform during the 2007-08 and 2008-2009 wet seasons**

| Site | Single Sample Criterion Exceedance Frequency (%) | | | | Geometric Mean Criterion Exceedance Frequency (%) | |
|---|---|---|---|---|---|---|
| | 2007-2008 | | 2008-2009 | | 2007-2008 | 2008-2009 |
| | Dry Weather | Wet Weather | Dry Weather | Wet Weather | | |
| Prado Park Lake | 21% | 100% | 20% | 75% | 10% | 30% |
| Chino Creek | 73% | 100% | 30% | 100% | 93% | 100% |
| Mill Creek | 75% | 100% | 33% | 80% | 97% | 100% |
| SAR @ MWD Crossing | 50% | 100% | 0% | 67% | 70% | 40% |
| SAR @ Pedley Ave. | 55% | 100% | 0% | 67% | 73% | 40% |

**Table 3-12. Compliance frequency for *E. coli* during the 2007-08 and 2008-2009 wet seasons**

| Site | Single Sample Criterion Exceedance Frequency (%) * | | | | Geometric Mean Criterion Exceedance Frequency (%) | |
|---|---|---|---|---|---|---|
| | 2007-2008 | | 2008-2009 | | 2007-2008 | 2008-2009 |
| | Dry Weather | Wet Weather | Dry Weather | Wet Weather | | |
| Prado Park Lake | 15% | 0% | 40% | 100% | 53% | 70% |
| Chino Creek | 73% | 100% | 60% | 100% | 100% | 100% |
| Mill Creek | 75% | 100% | 89% | 100% | 100% | 100% |
| SAR @ MWD Crossing | 28% | 100% | 0% | 67% | 73% | 40% |
| SAR @ Pedley Ave. | 23% | 100% | 25% | 83% | 63% | 40% |

# Section 4
# Compliance with Load Allocations

## 4.1 Background

The TMDL contains load allocations (LA) for agricultural runoff discharges and natural sources. These LAs are the same as the WLAs that have been established for urban dischargers and CAFOs. Section 1.2 summarizes these allocations.

As noted previously, the watershed-wide compliance monitoring program samples five locations on a regular basis, which includes natural sources during dry and wet weather and agricultural discharges during runoff events. Monitoring specific to agriculture discharges has also occurred during wet weather. Monitoring that targets natural sources has not occurred during the past three years. The following sections provide information on FIB concentrations observed during agricultural discharge monitoring.

## 4.2 Agricultural Source Monitoring Program

Agricultural dischargers implemented a source evaluation program in 2008. This program included wet weather sampling at selected sites in the MSAR watershed where agricultural activity occurs. Sampling occurred during two separate storm events at four sites (Table 4-1, Figure 4-1). During a storm event, two samples are collected from each site 30 minutes apart. Sampling methods are consistent with the watershed-wide compliance monitoring program. Specific details are provided in the MSAR Monitoring Plan (SAWPA 2008a) and associated Quality Assurance Project Plan (SAWPA 2008b).

## 4.3 Bacterial Indicator Concentrations

Table 4-2 summarizes wet weather monitoring results for the two storm events sampled in 2009. Concentrations of FIB exceeded the LAs established for agriculture discharges at all four sample sites during both storm events. Limited sampling data from these sites prevents making any evaluation of trends at these locations.

**Table 4-1. Agriculture Discharge Monitoring Site Locations**

| Site Description | Latitude | Longitude |
|---|---|---|
| Grove Avenue Channel at Merrill Avenue (AG-G2) | 33 58.986 | -117 37.685 |
| Eucalyptus Avenue at Walker Avenue (AG-G1) | 33 59.425 | -117 37.163 |
| Euclid Avenue Channel at Pine Avenue (AG-E2) | 33 57.220 | -117 38.926 |
| Eucalyptus Avenue at Cleveland Avenue (*Backup to Walker Avenue, depending on flow conditions)* (AG-CL1) | 33 59.405 | -117 34.031 |
| Cypress Channel at Kimball Avenue (AG-CYP1) | 33.96888 | -117.66043 |

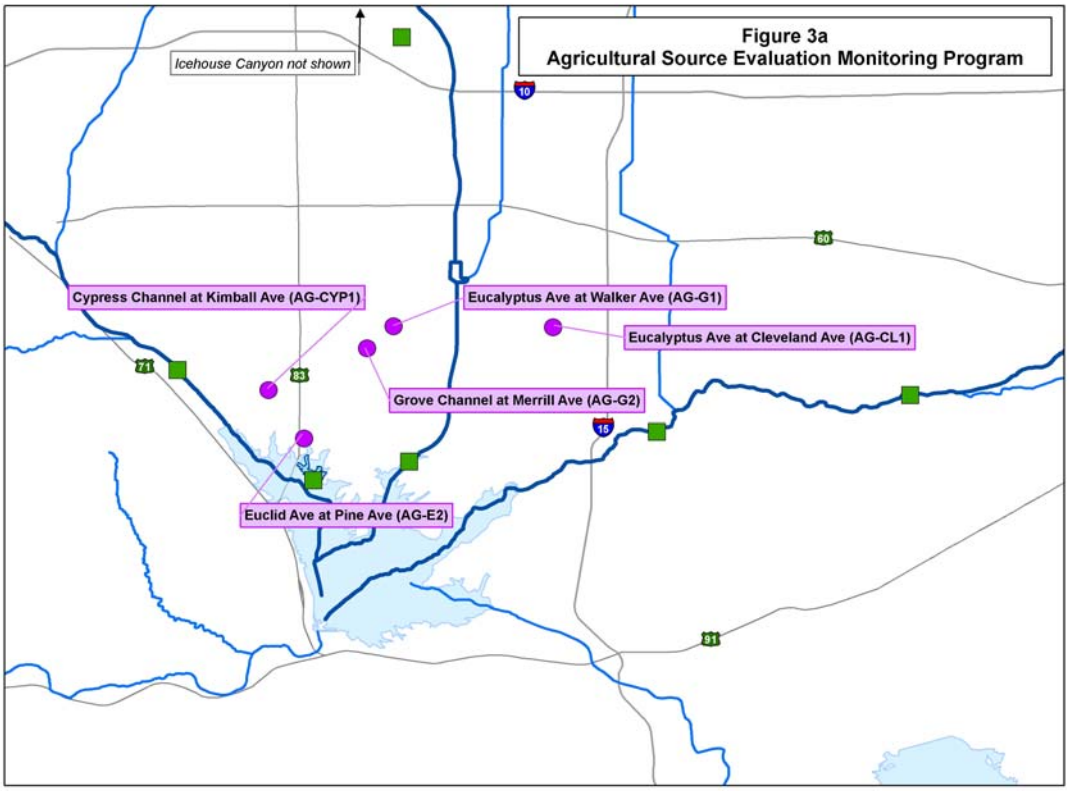



**Figure 4-1. Location of agriculture discharge monitoring sites in relation to the watershed-wide compliance monitoring sites (originally Figure 3a in the Monitoring Plan, see SAWPA 2008a).**

**Table 4-2. FIB concentrations observed at agriculture discharge sites during two storm events sampled in 2009. Each site is sampled twice, 30 minutes apart, during each storm event.**

| FIB | Event | Cypress Channel at Kimball Ave (CYP1) | | Grove Ave. Channel at Merrill Ave. (G2) | | Euclid Ave. Channel at Pine Ave. (E2) | | Eucalyptus Ave. at Walker Ave. (G1)[1] | | Eucalyptus Ave. at Cleveland Ave. (CL-1)[1] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| ***E. coli*** | **Storm 1 (2/16/09)** | 17,000 | 24,000 | >= 160,000 | >= 160,000 | 3,000 | 5,000 | >= 160,000 | >= 160,000 | No Sample | No Sample |
| | **Storm 2 (12/12/09)** | 130,000 | 30,000 | 80,000 | 170,000 | 4,000 | 4,000 | No Sample | No Sample | 7,000 | 2,000 |
| **Fecal coliform** | **Storm 1 (2/16/09)** | 17,000 | 24,000 | >= 160,000 | >= 160,000 | 3,000 | 13,000 | >= 160,000 | >= 160,000 | No Sample | No Sample |
| | **Storm 2 (12/12/09)** | 240,000 | 130,000 | 130,000 | 210,000 | 4,000 | 8,000 | No Sample | No Sample | 7,000 | 2,000 |

[1] – CL-1 sample location was established as a back-up location if little or no flow occurred at G1. During Storm 1 site G1 was sampled; during Storm 2 site CL-1 was sampled instead.

# Section 5
# References


Regional Water Quality Control Board (RWQCB). 2005. *Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate Bacterial Indicator Total Maximum Daily Loads (TMDLs) for Middle Santa Ana River Watershed Waterbodies.* Regional Board Resolution R8-2005-0001.

SAWPA. 2008a. *Middle Santa Ana River Water Quality Monitoring Plan*. Prepared by CDM on behalf of SAWPA and the Middle Santa Ana River Watershed TMDL Task Force. April, 2008.

SAWPA. 2008b. *Quality Assurance Project Plan for the Middle Santa Ana River Pathogen TMDL – BMP Implementation Project*. Prepared by CDM on behalf of SAWPA and the Middle Santa Ana River Watershed TMDL Task Force. April, 2008.

SAWPA. 2009a. *Middle Santa Ana River Bacterial Indicator TMDL Data Analysis Report.* Prepared by CDM on behalf of SAWPA and the Middle Santa Ana River Watershed TMDL Task Force. March, 2009.

SAWPA. 2009b. *Middle Santa Ana River Bacterial Indicator TMDL 2008 Dry Season Report*. Prepared by CDM on behalf of SAWPA and the Middle Santa Ana River Watershed TMDL Task Force. March, 2009.

SAWPA. 2009c. *Middle Santa Ana River Bacterial Indicator TMDL 2008-2009 Wet Season Report*. Prepared by CDM on behalf of SAWPA and the Middle Santa Ana River Watershed TMDL Task Force. May, 2009.

SAWPA. 2009d. *Middle Santa Ana River Bacterial Indicator TMDL 2009 Dry Season Report*. Prepared by CDM on behalf of SAWPA and the Middle Santa Ana River Watershed TMDL Task Force. December, 2009.